Milano, 28 Febbraio 2013

Eco da sforzo nella valutazione delle valvulopatie

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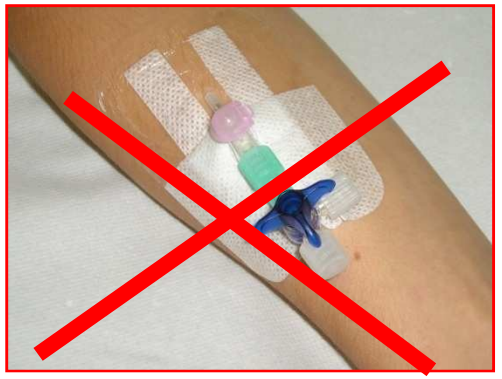
FONDAZIONE POLIAMBULANZA
Istituto Ospedaliero

Ecocardiogramma da sforzo

Semplicità di esecuzione

Basso costo



European Heart Journal (2012) **33**, 2451–2496
doi:10.1093/eurheartj/ehs109

Guidelines on the management of valvular heart disease (version 2012)

The Joint Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Table 3 Essential questions in the evaluation of a patient for valvular intervention

• Is valvular heart disease severe?
• Does the patient have symptoms?
• Are symptoms related to valvular disease?
• What are patient life expectancy[a] and expected quality of life?
• Do the expected benefits of intervention (vs. spontaneous outcome) outweigh its risks?
• What are the patient's wishes?
• Are local resources optimal for planned intervention?

Table 6 Management of coronary artery disease in patients with valvular heart disease

	Class [a]	Level [b]
Diagnosis of coronary artery disease		
Coronary angiography[c] is recommended before valve surgery in patients with severe valvular heart disease and any of the following: • history of coronary artery disease • suspected myocardial ischaemia[d] • left ventricular systolic dysfunction • in men aged over 40 years and postmenopausal women • ≥1 cardiovascular risk factor.	I	C
Coronary angiography is recommended in the evaluation of secondary mitral regurgitation.	I	C
Indications for myocardial revascularization		
CABG is recommended in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥70%.[e]	I	C
CABG should be considered in patients with a primary indication for aortic/mitral valve surgery and coronary artery diameter stenosis ≥50–70%.	IIa	C

CABG = coronary artery bypass grafting.
[a]Class of recommendation.
[b]Level of evidence.
[c]Multi-slice computed tomography may be used to exclude coronary artery disease in patients who are at low risk of atherosclerosis.
[d]Chest pain, abnormal non-invasive testing.
[e]≥50% can be considered for left main stenosis.
Adapted from Wijns *et al.*[20]

European Heart Journal (2007) **28**, 230–268
doi:10.1093/eurheartj/ehl428

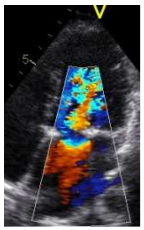
ESC Guidelines

Guidelines on the management of valvular heart disease

The Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology

Exercise echocardiography

Promising recent reports suggest that the estimation of the prognosis of VHD and indications for intervention may be refined by measuring changes in gradients or degree of regurgitation on exercise.[24,25] Echocardiography performed immediately after exercise has shown to be useful to assess the prognosis of degenerative MR.[26]



Bonow et al ACC/AHA VHD Guidelines: 2008 Focused Update Incorporated

2.1.6. Exercise Testing

Exercise testing can provide valuable information in patients with valvular heart disease, especially in those whose symptoms are difficult to assess.

It can be combined with echocardiography, radionuclide angiography, and cardiac catheterization.

Eco da sforzo nella valutazione funzionale delle valvulopatie

- Fattibilità, criteri di valutazione e quantificazione
- Informazioni diagnostiche
- Valore prognostico
- Decisioni terapeutiche

- Insufficienza aortica: sintomi, Ventricolo Sinistro (VS)
- Stenosi aortica: sintomi, gradiente, VS, PAS, ECG
- Stenosi mitralica: sintomi, gradiente VM, PAPs
- Insufficienza mitralica: sintomi, entità rigurgito, meccanismo rigurgito, VS, PAPs

Eco da sforzo nell'**insufficienza aortica**: sintomi, VS

Exercise echocardiography predicts development of left ventricular dysfunction in medically and surgically treated patients with asymptomatic severe aortic regurgitation

S Wahi, B Haluska, A Pasquet, C Case, C M Rimmerman, T H Marwick

Abstract

Objective—To assess resting and exercise echocardiography for prediction of left ventricular dysfunction in patients with significant asymptomatic aortic regurgitation.

Design—Cohort study of patients with aortic regurgitation.

Setting—Tertiary referral centre specialising in valve surgery.

Patients—61 patients (38 men, 23 women; mean
minimally symptomatic aortic regurgitation and
treated medically and 26 had aortic valve replacem

Interventions—Exercise echocardiography was
measured on the resting and post-stress images
with an increment of ejection fraction after exerci
(CR+); those without an increment were labelled

Main outcome measures—Standard univariate
ing characteristic analyses were used to assess the
up ejection fraction.

Results—In the 35 medically treated patients, 13 of
tion increment 7 (3)%) had preserved ejection frac
(ejection fraction decrement 8 (4)%), 13 (93%) ha
from 60 (5)% at baseline to 54 (3)% on follow up
sions; medical treatment, aortic regurgitation severi
were similar in both CR+ and CR− groups. Among
tion fraction increase 9 (5)%), all of whom had an increase in e
49% to 59%). Of 13 surgical patients with CR− (ejection
showed the same or worse ejection fraction on postoperati

Conclusions—Contractile reserve on exercise echocardiography is a better predictor of left ventricular decompensation than resting indices in asymptomatic patients with aortic regurgitation. In patients undergoing aortic valve replacement, contractile reserve had a better correlation with resting ejection fraction on postoperative follow up. Measurement of contractile reserve may be useful to monitor the early development of myocardial dysfunction in asymptomatic patients with aortic regurgitation, and may help to optimise the timing of surgery.

(*Heart* 2000;84:606–614)

In pazienti asintomatici con insufficienza aortica di grado severo: La riserva contrattile durante eco da sforzo è un predittore di scompenso ventricolare sinistro migliore rispetto agli indici a riposo

ACCF/ASE/ACEP/AHA/ASNC/SCAI/SCCT/SCMR 2008 Appropriateness Criteria for Stress Echocardiography*

A Report of the American College of Cardiology Foundation Appropriateness Criteria Task Force, American Society of Echocardiography, American College of Emergency Physicians, American Heart Association, American Society of Nuclear Cardiology, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance

Score di appropriatezza: 1-9

Table 9. Stress Study for Hemodynamics (Includes Doppler During Stress)

• Asymptomatic severe AI or MR • LV size and function not meeting surgical criteria	A (7)
• Severe AI or MR • Symptomatic or with severe LV enlargement or LV systolic dysfunction	I (2)

ASINTOMATICI con IAO di grado SEVERO, se NON sono già presenti i criteri chirurgici di dilatazione e disfunzione ventricolare

Eco da sforzo nella **stenosi aortica**: sintomi, gradiente, VS, PAS, ECG

Prognostic Importance of Quantitative Exercise Doppler Echocardiography in Asymptomatic Valvular Aortic Stenosis

Patrizio Lancellotti, Florence Lebois, Marc Simon, Christophe Tombeux, Christophe Chauvel and Luc A. Pierard

Circulation 2005;112;I-377-I-382

Exercise Echocardiography

A symptom-limited graded bicycle exercise test was performed in a semisupine position on a tilting exercise table allowing continuous 2D and Doppler echocardiographic examination. After an initial workload of 25 W maintained for 2 minutes, the workload was increased every 2 minutes by 25 W. Blood pressure and a 12-lead ECG were recorded every 2 minutes. The exercise test was considered to be abnormal in the presence of ≥1 of the following abnormalities: angina, dyspnea, ≥2 mm ST segment depression 80 ms after the J point, fall or small (<20 mm Hg) rise in systolic blood pressure as compared with baseline, and significant arrhythmias.[2]

Eco da sforzo nella **stenosi aortica**: sintomi, gradiente, VS, PAS, ECG

TABLE 3. Multivariate Predictors of Events

Categorical Variables	χ	*P* Value
Mean aortic pressure gradient diff ≥18 mm Hg	10	0.015
Abnormal exercise test	9.1	0.0026
Aortic valve area <0.75 cm	8.7	0.0031

Diff indicates difference between exercise and rest.

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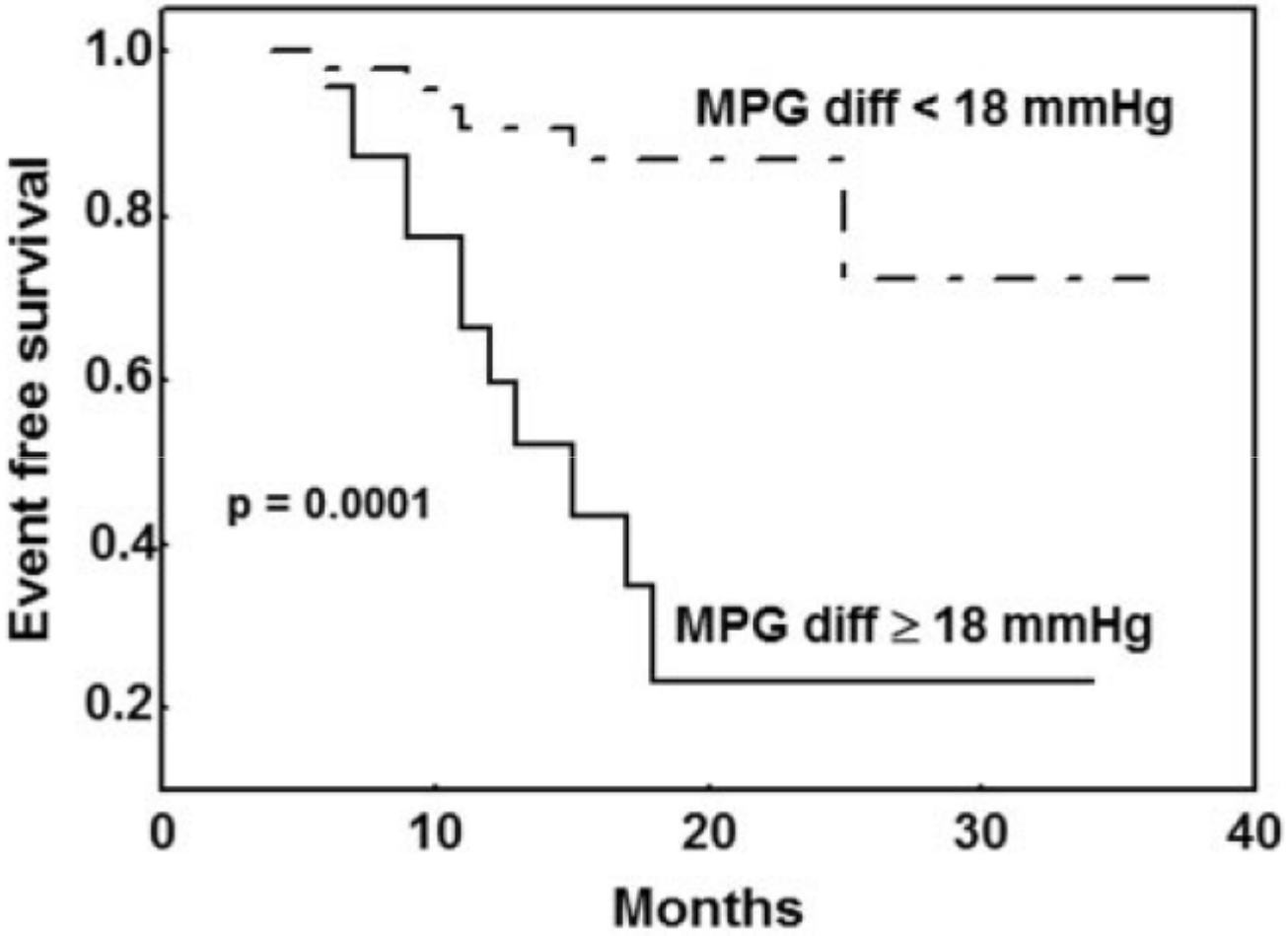
Eco da sforzo nella **stenosi aortica**: sintomi, gradiente, VS, PAS, ECG



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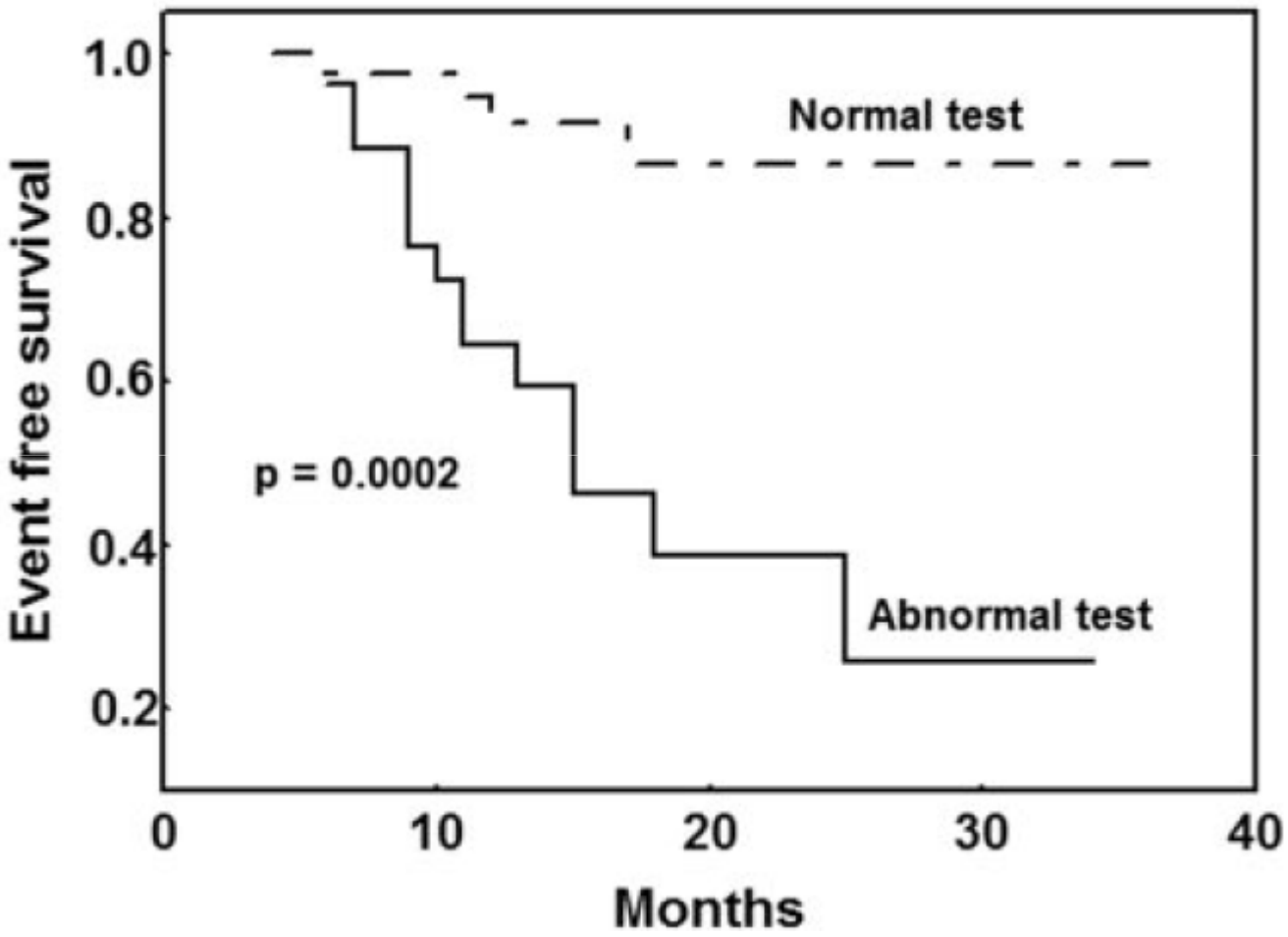

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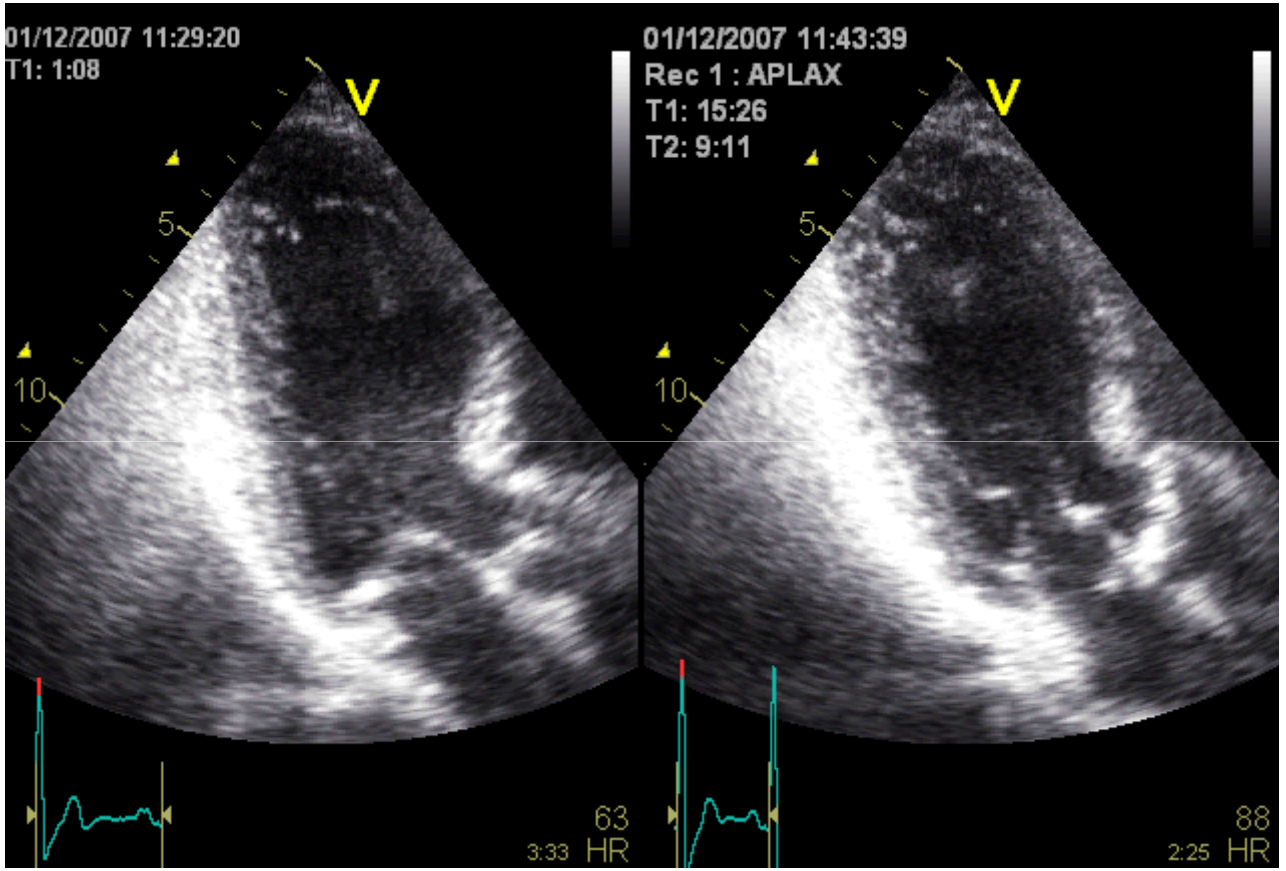
Eco da sforzo nella **stenosi aortica**: sintomi, gradiente, VS, PAS, ECG

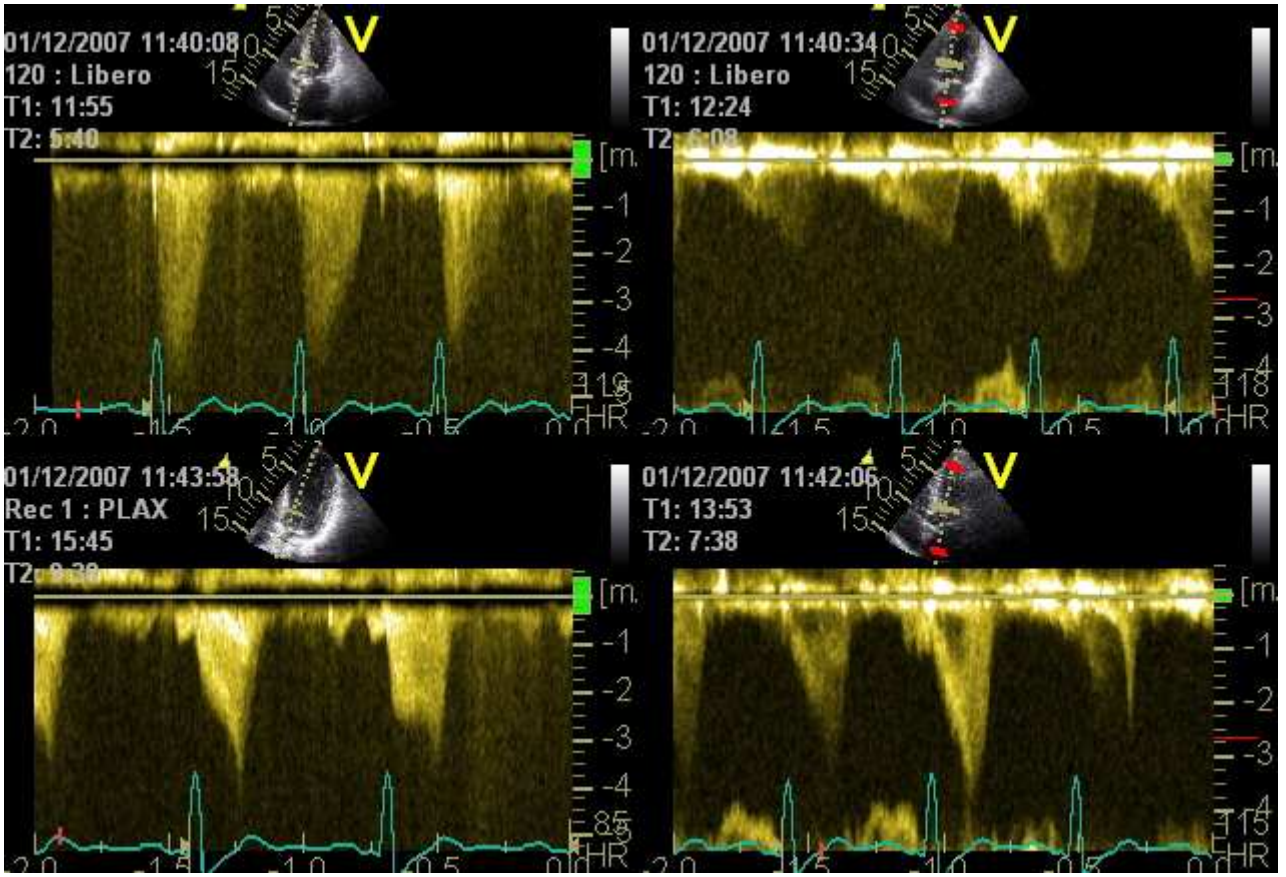


riposo **1’ recupero**

Eco da sforzo nella **stenosi aortica**: sintomi, gradiente, VS, PAS, ECG

120 Watt

REC 1'

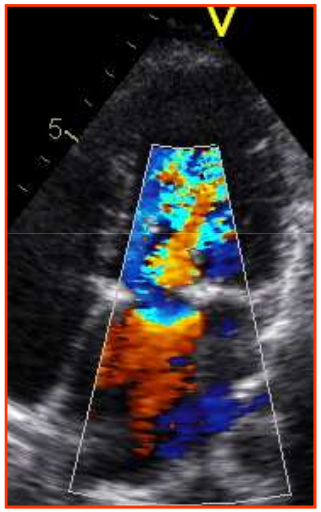


CWD

HPRF PWD

Ecocardiogramma da sforzo e valvulopatia mitralica

Stenosi



Fattibilità

Utilità

- **DIAGNOSI**
- **PROGNOSI**
- **SCELTA TERAPEUTICA**

Appropriatezza

Insufficienza

Eco da sforzo nella **stenosi mitralica**: sintomi, gradiente VM, PAPs

ACCF/ASE/ACEP/AHA/ASNC/SCAI/SCCT/SCMR 2008 Appropriateness Criteria for Stress Echocardiography*

Stenosi mitralica

A Report of the American College of Cardiology Foundation Appropriateness Criteria Task
American Society of Echocardiography, American College of Emergency Physicians,
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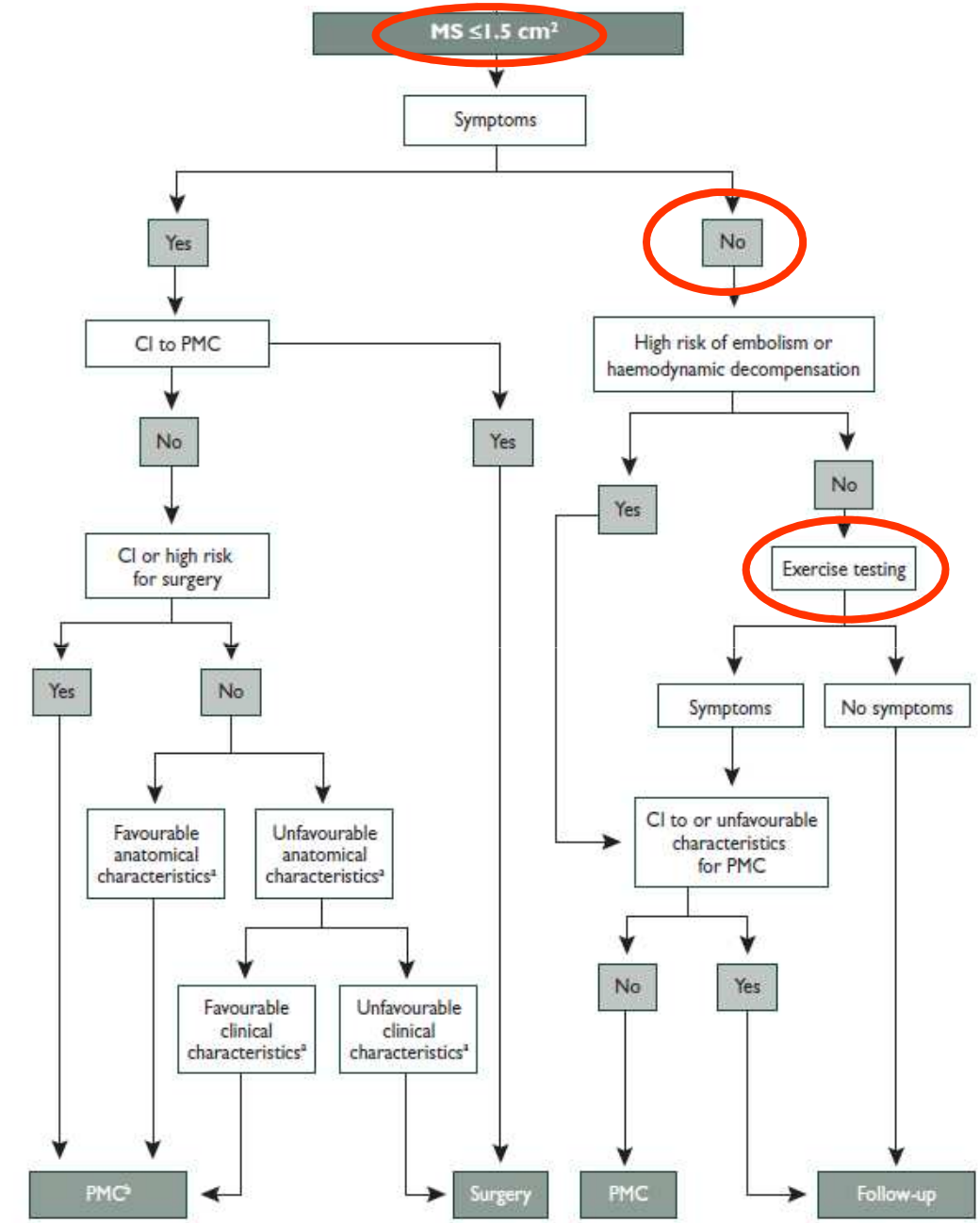
Society for Cardiovascular Angiography and Interventions,
Society of Cardiovascular Computed Tomography,
and Society for Cardiovascular Magnetic Resonance

Score di appropriatezza: 1-9

Table 9. Stress Study for Hemodynamics (Includes Doppler During Stress)

• Asymptomatic individuals • Mild to moderate mitral stenosis	U (5)
• Symptomatic individuals • Mild mitral stenosis	A (7)

SINTOMATICI **con SM di grado lieve**
ASINTOMATICI **con SM di grado da lieve a moderato**

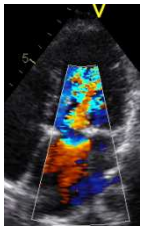


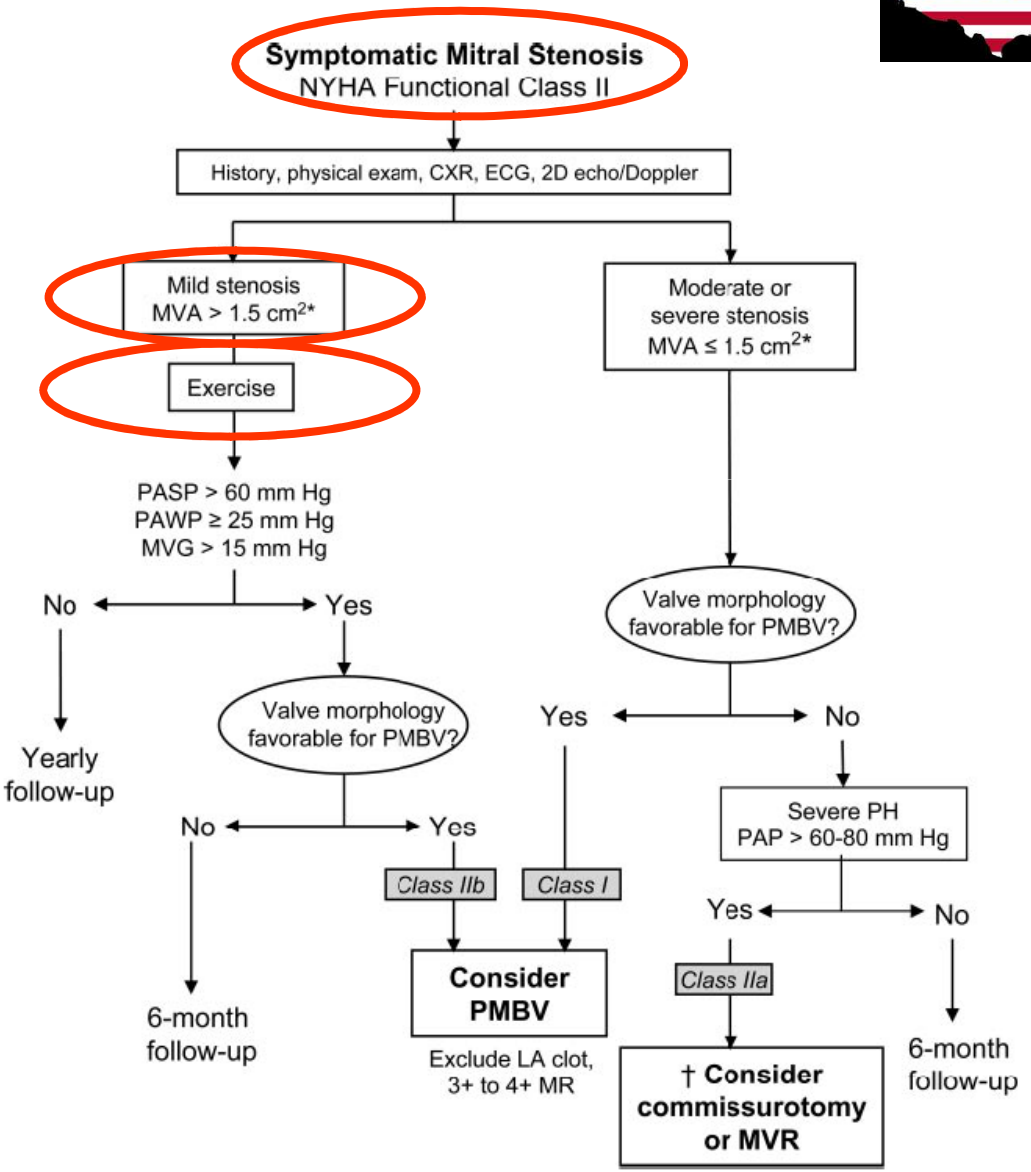
CI = contraindication; MS = mitral stenosis; PMC = percutaneous mitral commissurotomy.
[a]See *Table 14*.
[b]Surgical commissurotomy may be considered by experienced surgical teams or in patients with contraindications to percutaneous mitral commissurotomy.

2008 Focused Update Incorporated Into the ACC/AHA 2006 Guidelines for the Management of Patients With Valvular Heart Disease

Circulation. **2008;118:e523-e661**

Stenosi mitralica





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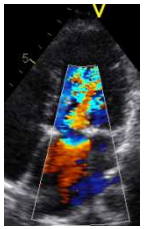
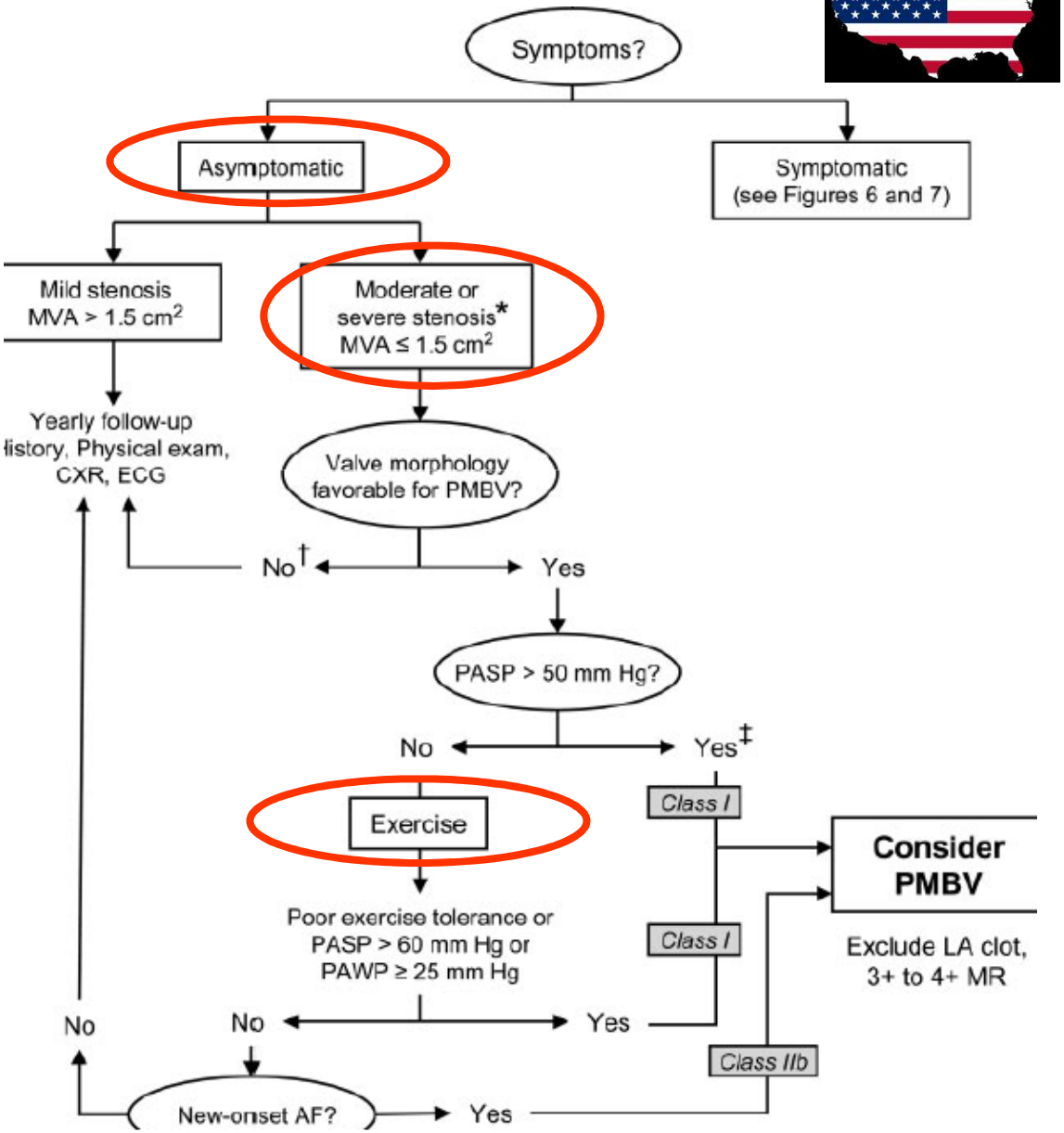
Circulation. **2008;118:e523-e661**

Stenosi mitralica





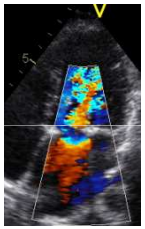
Guidelines on the management of valvular heart disease

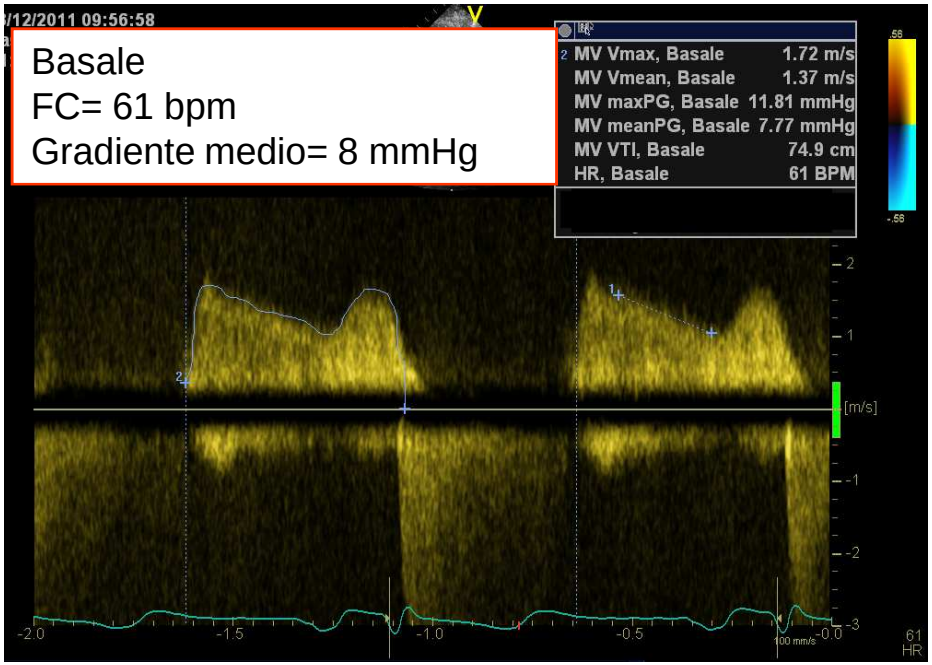
European Heart Journal (2007) 28, 230–268

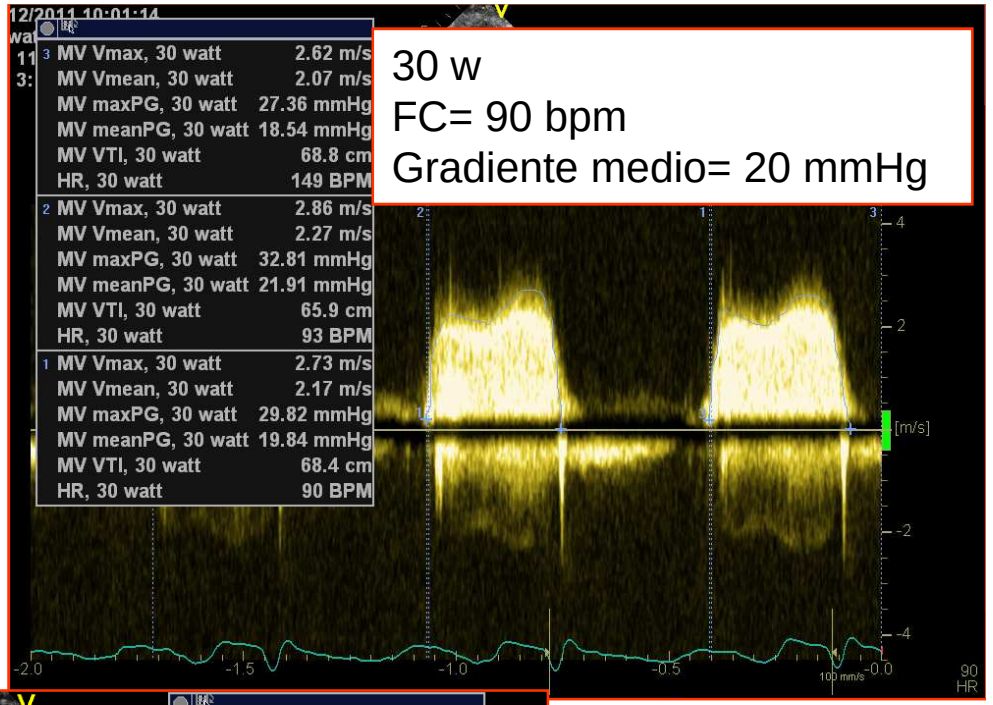
Stenosi mitralica

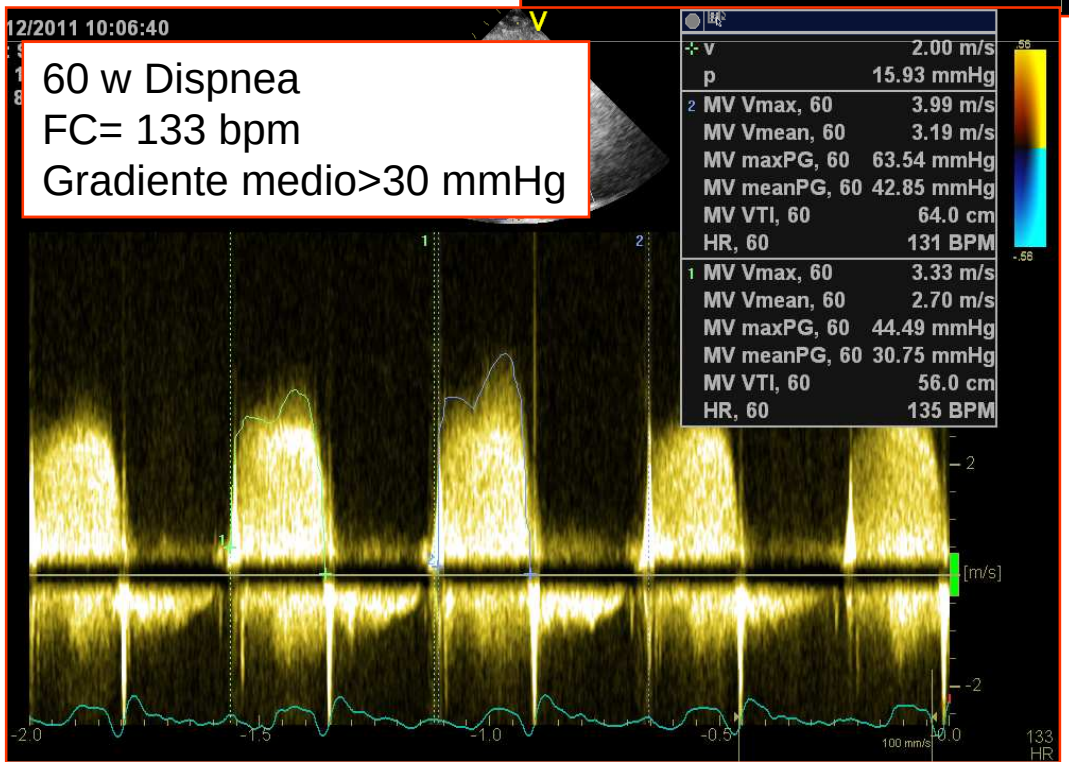
MS = mitral stenosis
CI = contra-indication
PMC = percutaneous mitral commissurotomy

*See *Table 12* for definitions

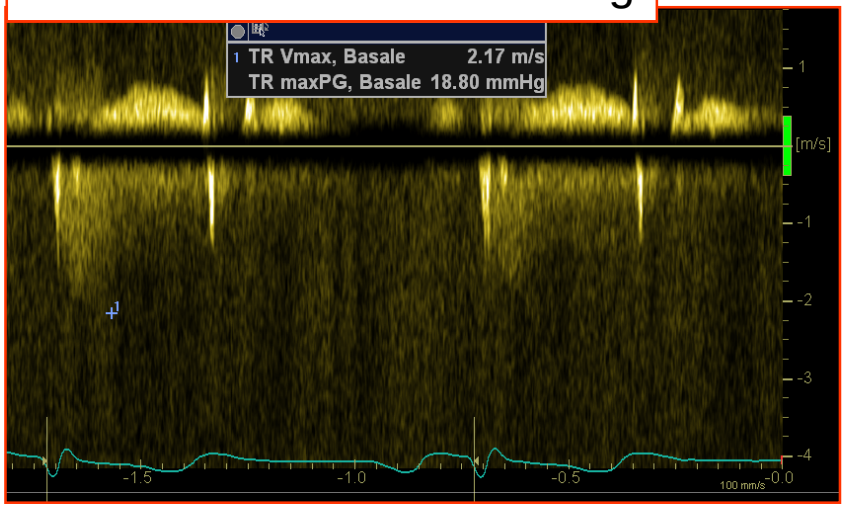



Basale
FC= 61 bpm
Gradiente medio= 8 mmHg
MV Vmax, Basale 1.72 m/s
MV Vmean, Basale 1.37 m/s
MV maxPG, Basale 11.81 mmHg
MV meanPG, Basale 7.77 mmHg
MV VTI, Basale 74.9 cm
HR, Basale 61 BPM
[m/s]
61 HR

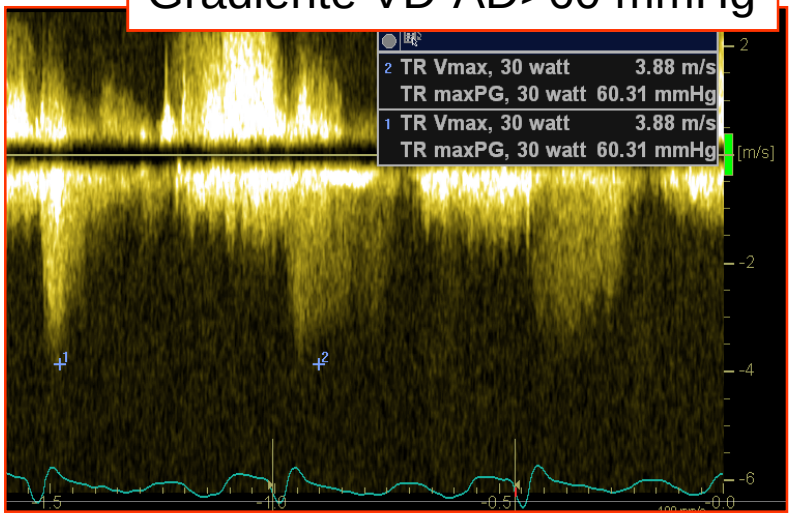

30 w
FC= 90 bpm
Gradiente medio= 20 mmHg
MV Vmax, 30 watt 2.62 m/s
MV Vmean, 30 watt 2.07 m/s
MV maxPG, 30 watt 27.36 mmHg
MV meanPG, 30 watt 18.54 mmHg
MV VTI, 30 watt 68.8 cm
HR, 30 watt 149 BPM
MV Vmax, 30 watt 2.86 m/s
MV Vmean, 30 watt 2.27 m/s
MV maxPG, 30 watt 32.81 mmHg
MV meanPG, 30 watt 21.91 mmHg
MV VTI, 30 watt 65.9 cm
HR, 30 watt 93 BPM
MV Vmax, 30 watt 2.73 m/s
MV Vmean, 30 watt 2.17 m/s
MV maxPG, 30 watt 29.82 mmHg
MV meanPG, 30 watt 19.84 mmHg
MV VTI, 30 watt 68.4 cm
HR, 30 watt 90 BPM
[m/s]
90 HR


60 w Dispnea
FC= 133 bpm
Gradiente medio>30 mmHg
v 2.00 m/s
p 15.93 mmHg
MV Vmax, 60 3.99 m/s
MV Vmean, 60 3.19 m/s
MV maxPG, 60 63.54 mmHg
MV meanPG, 60 42.85 mmHg
MV VTI, 60 64.0 cm
HR, 60 131 BPM
MV Vmax, 60 3.33 m/s
MV Vmean, 60 2.70 m/s
MV maxPG, 60 44.49 mmHg
MV meanPG, 60 30.75 mmHg
MV VTI, 60 56.0 cm
HR, 60 135 BPM
[m/s]
133 HR

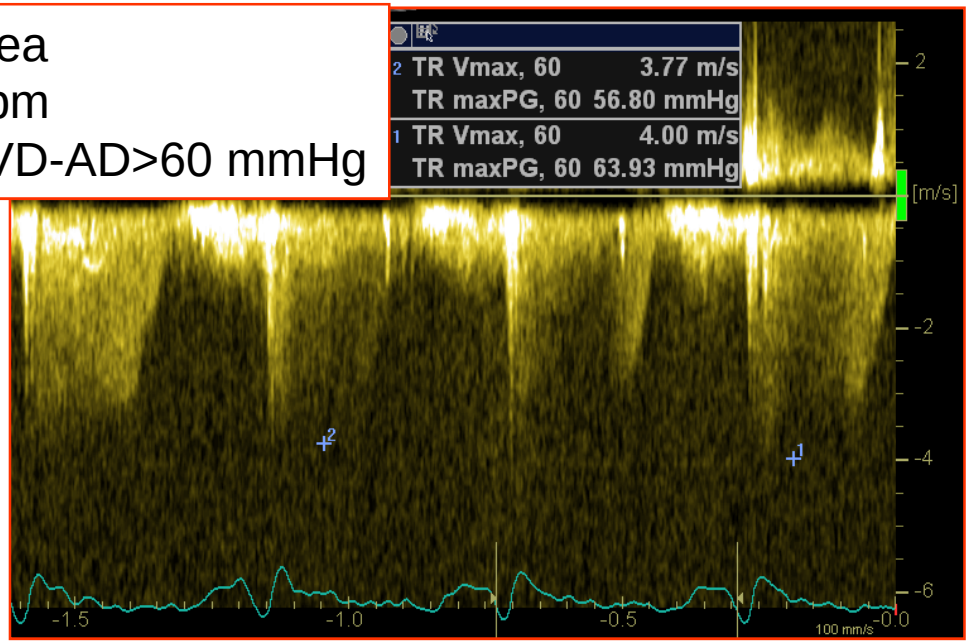
Basale
FC= 60 bpm
Gradiente VD-AD<20 mmHg



30 w
FC= 90 bpm
Gradiente VD-AD>60 mmHg



60 w Dispnea
FC= 130 bpm
Gradiente VD-AD>60 mmHg



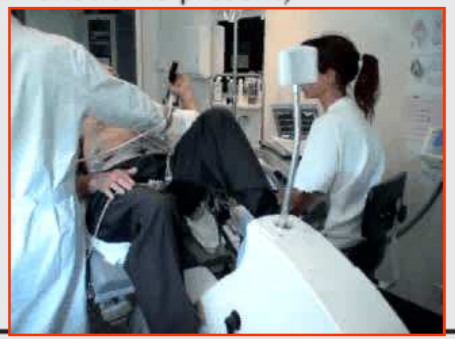
Eco da sforzo nell'**insufficienza mitralica**:

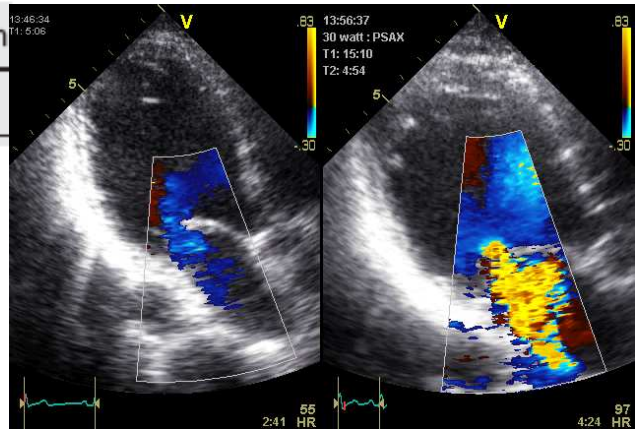
sintomi, entità rigurgito, meccanismo rigurgito, VS, PAPs

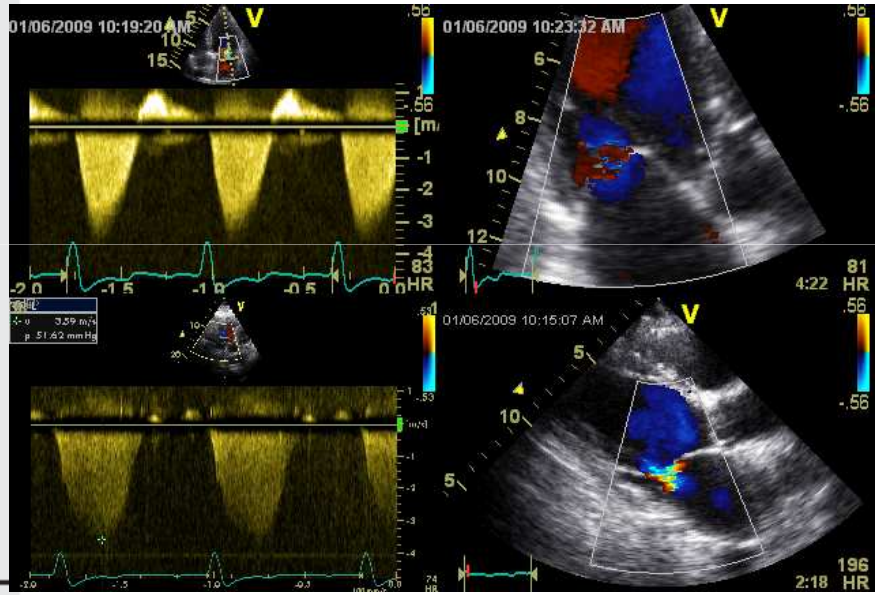
- Fattibilità, criteri di valutazione e quantificazione
- Informazioni diagnostiche
- Valore prognostico
- Decisioni terapeutiche

Table 2 Criteria for the definition of severe valve regurgitation—an integrative approach

	MR
Specific signs of severe regurgitation	Vena contracta width ≥0.7 cm with large central MR jet (area >40% of LA) or with a wall impinging jet of any size, swirling in LA[a]
	Large flow convergence[b]
	Systolic reversal in pulmonary veins
	Prominent flail MV or ruptured papillary muscle
Supportive signs	Dense, triangular CW, Doppler MR jet
	E-wave dominant mitral inflow (E >1.2 m/s)[c]
	Enlarged LV and LA size[e] (particularly when normal LV function is present)
Quantitative parameters	
R Vol, mL/beat	≥60
RF, %	≥50
ERO, cm^2	≥0.40







AR = aortic regurgitation, CW = continuous wave, ERO = effective regurgitant orifice area, LA = left atrium, LV = left ventricle, LVOT = LV outflow tract, MR = mitral regurgitation, MS = mitral stenosis, MV = mitral valve, R Vol = regurgitant volume, RA = right atrium, RF = regurgitant fraction, RV = right ventricle, TR = tricuspid regurgitation.

[a]At a Nyquist limit of 50–60 cm/s.

[b]Large flow convergence defined as flow convergence radius ≥0.9 cm for central jets, with a baseline shift at a Nyquist of 40 cm/s; cut-offs for eccentric jets are higher and should be angled correctly.

[c]Usually above 50 years of age or in conditions of impaired relaxation, in the absence of MS or other causes of elevated LA pressure.

[d]In the absence of other aetiologies of LV dilatation.

[e]In the absence of other aetiologies of LV and LA dilatation and acute MR.

Adapted from Zoghbi *et al.*[19]

Exercise echocardiography in the evaluation of functional mitral regurgitation: A systematic review of the literature

Damian Cieślikowski, Tomasz Baron and Tomasz Grodzicki

Table 3. Echocardiographic parameters used in the evaluation of mitral regurgitation.

Echocardiographic parameter	Publication number																
	1	2	14	16	17	7	15	8	18	3	6	5	11	10	9	12	13
Mitral regurgitant jet volume (RVol)	+			+		+		+	+			+	+		+	+	+
Regurgitant jet fraction (RVol/LV stroke volume)						+		+				+	+		+		
ERO	+	+	+	+	+			+								+	+
Mitral regurgitant jet area										+	+			+			
Regurgitant jet/LA area						+	+		+								
VCW									+								
Tricuspid regurgitation	+			+	+				+				+			+	+
Mitral annulus diameter			+			+			+					+		+	
Mitral annulus area		+											+				
Coaptation height		+	+			+								+			
Tenting area	+	+	+														
LVDF				+						+	+		+				
WMSI	+	+	+							+	+			+			
LADA	+		+										+				
LVEDD																	
LVESD					+	+	+		+		+		+			+	
LVEDV																	
LVESV	+	+	+	+								+		+	+	+	
LVSI			+			+											
LVEF	+	+	+	+	+	+	+			+	+	+		+		+	+
LVSV						+	+	+				+	+		+		
CO						+						+					

LA — left atrium; LV — left ventricle; VCW — vena contracta width; ERO — effective regurgitation orifice area; LVEDD — LV end-diastolic di
LVESD — LV end-systolic dimension; LVEDV — LV end-diastolic volume; LVESV — LV end-systolic volume; LVSV — LV stroke volume; WM
wall motion score index; LVDEF — LV diastolic function; LADA — dimensions and/or area; LVSI — sphericity index; LVEF — left ventricular ejection fraction; CO — cardiac output

IM "funzionale"

N°	studi
13	DISFUNZIONE VS
2	CONSECUTIVI
2	IM a riposo e FE>50%

Cardiol J 2007; 14: 436–446

Determinants of Exercise-Induced Changes in Mitral Regurgitation in Patients With Coronary Artery Disease and Left Ventricular Dysfunction

Patrizio Lancellotti, MD, Frédéric Lebrun, MD, Luc A. Piérard, MD, *Liège, Belgium*

IM "funzionale"

Table 3. Changes in the ERO With Exercise and Patient Characteristics

Exercise-Resting Data	ERO: Decreased (n = 13)	ERO: Increased <13 mm² (n = 38)	ERO: Increased ≥13 mm² (n = 19)	p for Trend	Correlation With ERO: r	Correlation With ERO: p
Left atrial area (cm²)	−1.0 ± 2.9	1.5 ± 3.6	1.8 ± 3.3	†	0.23 (0.23, 0.49)	0.06†
Hemodynamic data						
Heart rate (beats/min)	37 ± 16	39 ± 16	38 ± 14	—	0.07 (0.16, 0.12)	0.54
Systolic arterial pressure (mm Hg)	29 ± 16	28 ± 19	20 ± 11	—	0.12 (0.13, 0.18)	0.34
Global LV remodeling						
EDV (ml)	−4.9 ± 13	0.5 ± 21	0.9 ± 21	—	0.10 (0.09, 0.01)	0.40
ESV (ml)	−11 ± 13	−13 ± 19	−7 ± 14	—	0.15 (0.14, 0.08)	0.24
EF (%)	6.8 ± 7.7	10 ± 7.4	5.5 ± 3.1	†	0.18 (0.16, 0.19)	0.14
Mitral valvular deformation						
Tenting area (cm²)	−1.1 ± 0.9	0.44 ± 0.65	1.6 ± 0.75	< 0.000001*†	0.85 (0.86, 0.84)	< 0.000001*†
Coaptation height (cm)	−0.2 ± 0.2	0.03 ± 0.15	0.28 ± 0.20	0.000001*†	0.81 (0.89, 0.78)	0.000001*†
Diastolic MA area (cm²)	−0.4 ± 0.7	0.3 ± 0.4	0.7 ± 0.8	0.00002*†	0.54 (0.66, 0.31)	0.00002*
Systolic MA area (cm²)	−0.5 ± 0.8	0.3 ± 0.4	1.0 ± 0.7	< 0.000001*†	0.78 (0.83, 0.79)	0.000001*†
MA contraction (%)	2.0 ± 12	−1.1 ± 4.6	7.5 ± 14	0.013†	0.44 (0.54, 0.57)	0.00016*†
Local LV remodeling						
PMs separation (mm)	0.38 ± 2.3	−0.5 ± 2.2	−0.4 ± 2.6	—	0.15 (0.31, 0.15)	0.31
PPM-fibrosa (cm)	−1.9 ± 2.7	−3.8 ± 3.4	−0.3 ± 5.4	0.0445	0.06 (0.32, 0.30)	0.69
PPM posterior (mm)	−2.3 ± 1.6	−0.5 ± 1.6	1.4 ± 1.9	0.00006†	0.68 (0.43, 0.63)	0.000001†
APM posterior (mm)	−2.1 ± 1.4	−0.7 ± 1.6	1.4 ± 2.3	0.00015	0.66 (0.48, 0.81)	0.000001*†
PPM lateral (mm)	−1.8 ± 1.5	−0.9 ± 1.5	0.4 ± 1.4	0.005	0.43 (0.31, 0.46)	0.002†
APM lateral (mm)	−1.0 ± 1.1	−0.2 ± 1.5	0.1 ± 1.7	—	0.06 (0.51, 0.26)	0.64*
WMI	−0.6 ± 0.19	−0.29 ± 0.15	−0.25 ± 0.19	0.000001†	0.50 (0.21, 0.68)	0.00002†

p = p value for the entire population; p ≤ 0.05: *anterior infarct patients, †inferior infarct patients; r for total population; in parentheses, r for anterior and inferior infarcts. APM = anterior papillary muscle; EDV = end-diastolic volume; EF = ejection fraction; ERO = effective regurgitant orifice; ESV = end-systolic volume; MA = mitral annular; PMs = papillary muscles; PPM = posterior papillary muscle; WMI = wall motion score index.

(J Am Coll Cardiol 2003;42:1921– 8)

Determinants of Exercise-Induced Changes in Mitral Regurgitation in Patients With Coronary Artery Disease and Left Ventricular Dysfunction

Patrizio Lancellotti, MD, Frédéric Lebrun, MD, Luc A. Piérard, MD, FESC
Liège, Belgium

IM "funzionale"

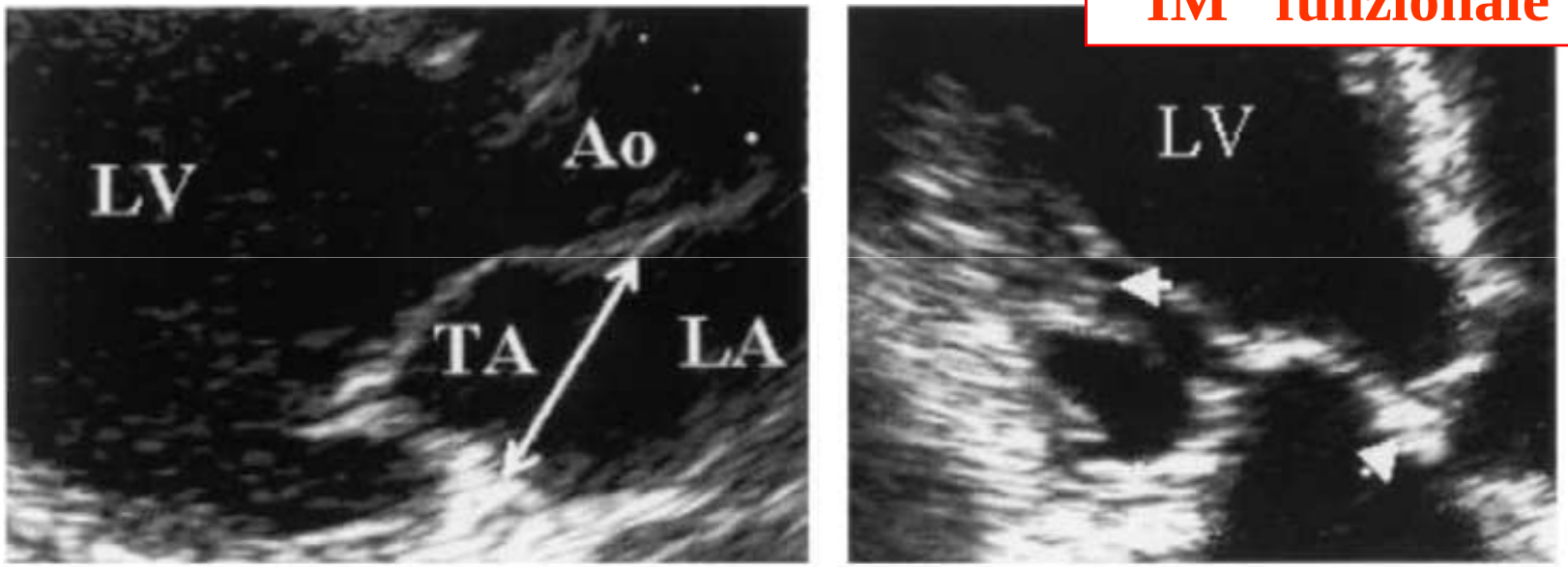


Figure 1. (Left) Parasternal long-axis view of aorta (Ao), left ventricle (LV), and left atrium (LA) showing tenting area (TA). **(Right)** Apical long-axis view demonstrating measurement of the distance between the posterior papillary muscle and the intervalvular fibrosa **(arrowheads)**.

(J Am Coll Cardiol 2003;42:1921– 8)

1. The PISA method can be performed during semi-supine exercise in a high proportion of patients with heart failure and funct
region is appropr
probably the mo
volume calculated
lated with the re
Doppler method,
2. Although it is more technically demanding, especially during exercise, the Doppler method can be an alternative in patients with a suboptimal flow-convergence definition.
3. Changes in vena contracta width can be useful, but only in patients with large exercise-induced increases of mitral regurgitant flow.
4. Regurgitant jet area and jet area to left atrial area ratios should not be used to assess functional MR during exercise.
5. Changes in systolic pulmonary artery pressure during exercise correlate well with increases in regurgitant volume. The latter, but not the former, distinguished patients who stopped exercise because of dyspnea from those who stopped because of fatigue.

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Quantitation of Functional Mitral Regurgitation During Bicycle Exercise in Patients With Heart Failure

IM "funzionale"

Frédéric Lebrun, MD, Patrizio Lancellotti, MD, Luc A. Piérard, MD, PHD, FESC
Liège, Belgium

ORIGINAL INVESTIGATIONS

IM "degenerativa"

DOI: 10.1111/j.1540-8175.2010.01200.x

Moderate Exercise Does Not Increase the Severity of Mitral Regurgitation Due to Mitral Valve Prolapse

Echocardiography 2010;27:1031-1037

Redi Pecini, M.D.,* Morten Dalsgaard, M.D.,* Daniel V. Møller, M.D.,* Morten S. Jensen, M.D.,* Klaus F. Kofoed, M.D.,‡ Walter Nielsen, M.D.,‡ Olav W. Nielsen, M.D.,§ Nis Høst, M.D.,§ Hanne Elming, M.D.,¶ Jens Peter Goetze, M.D.,† Christian Hassager, M.D.,* and Lars Køber, M.D.*

Variazioni ERO
P=0.6

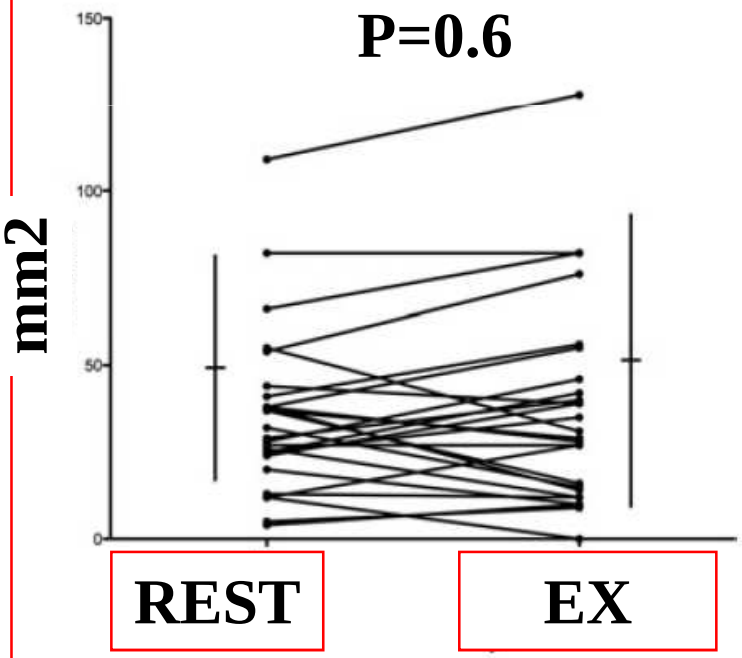

Figure 1. ERO changes from rest to peak exercise. Vertical bars represent mean values ± standard deviation. ERO = effective regurgitation orifice.

Variazioni Volume rigurgitante
P=0.02

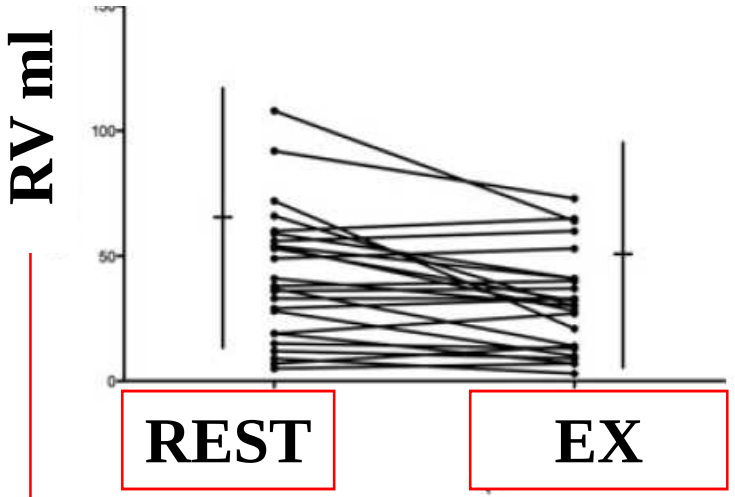

Figure 2. Regurgitation volume changes from rest to peak exercise. Vertical bars represent mean values ± standard deviation. RVol = regurgitation volume.

ORIGINAL INVESTIGATIONS

IM "degenerativa"

DOI: 10.1111/j.1540-8175.2010.01200.x

Moderate Exercise Does Not Increase the Severity of Mitral Regurgitation Due to Mitral Valve Prolapse

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Background: Mitral regurgitation (MR) secondary to ischemic heart disease (IHD) increases during exercise. We tested the hypothesis that the same is also true for MR due to mitral valve prolapse (MVP). Methods: Consecutive patients with asymptomatic MR of varying severity underwent exercise test on a supine bicycle with workload up to a maximum of 100 W. Echocardiographic measurements were performed at rest and at peak exercise. The study was designed to detect an effective regurgitant orifice (ERO) change of at least 10 mm^2 during exercise. Results: Twenty-six patients (21 male, age 56 ± 12 years (mean ± SD)) were included. Patients had an ERO of 35 ± 23 mm^2 (mean ± SD) and regurgitation volume of 48 ± 38 mL (mean ± SD). In these patients, ERO remained unchanged (an increase of 2 ± 15 mm^2 during exercise, $P = 0.6$). The regurgitation volume (RVol) decreased with 11 ± 16 mL (mean ± SD), $P = 0.003$. When calculated for 1 minute, RVol increased during exercise ($P = 0.01$), but in relation to the total cardiac output it decreased significantly ($P = 0.02$). Conclusion: Exercise does not increase the severity of MR due to MVP, in contrast to MR secondary to IHD. Different disease mechanisms behind these two types of MR could explain this difference. (Echocardiography 2010;27:1031-1037)

ORIGINAL INVESTIGATIONS

IM "degenerativa"

DOI: 10.1111/j.1540-8175.2010.01200.x

Moderate Exercise Does Not Increase the Severity of Mitral Regurgitation Due to Mitral Valve Prolapse

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Redi Pecini, M.D.,* Morten Dalsgaard, M.D.,* Daniel V. Møller, M.D.,* Morten S. Jensen, M.D.,* Klaus F. Kofoed, M.D.,‡ Walter Nielsen, M.D.,‡ Olav W. Nielsen, M.D.,§ Nis Høst, M.D.,§ Hanne Elming, M.D.,¶ Jens Peter Goetze, M.D.,† Christian Hassager, M.D.,* and Lars Køber, M.D.*

Rest
ERO 35
RVol 48

========

Stop
75 o 100 W

Fc max
118±16

TABLE I
Rest and Exercise Values for the Echocardiographic Parameters and NT-proBNP

Variable	Rest	Exercise	Change (exercise – rest)	P-value
Heart rate	67 ± 12	118 ± 16	48 ± 13	< 0.0001
Left ventricular diastolic diameter (mm)	53 ± 5	52 ± 5	−1 ± 4	0.2
Left ventricular systolic diameter (mm)	35 ± 6	32 ± 6	−2 ± 4	0.005
FS (%)	34 ± 8	37 ± 10	3 ± 7	0.02
Left atrial diameter (mm)	45 ± 6	45 ± 6	0 ± 3	0.8
Mitral valve area (cm^2)	10 ± 2	9 ± 2	−0.5 ± 1.3	0.1
Cardiac index ($mL/min/m^2$)	2.2 ± 0.6	4.3 ± 1.1	2.1 ± 0.6	< 0.0001
Tricuspidal gradient (mmHg)	20 ± 6	35 ± 14	15 ± 10	0.0003
ERO (mm^2)	35 ± 23	37 ± 29	2 ± 15	0.6
RVol (mL)	48 ± 38	36 ± 32	−11 ± 16	0.003
SV_{Ao} (mL)	65 ± 17	73 ± 21	8 ± 11	0.002
$RVol/SV_{Ao}$	0.9 ± 0.9	0.6 ± 0.7	−0.3 ± 0.3	0.002
NT-proBNP (pmol/L)	16 ± 17	17 ± 18	1 ± 2	0.02

ERO = effective regurgitant orifice; RVol = regurgitation volume.

Exercise-Induced Changes in Degenerative Mitral Regurgitation

IM "degenerativa"

Julien Magne, PhD, Patrizio Lancellotti, MD, PhD, Luc A. Piérard, MD, PhD

Liège, Belgium

J Am Coll Cardiol 2010;56:300–9

doi:10.1016/j.jacc.2009.12.073

Objectives We sought to quantify exercise-induced changes in patients with degenerative mitral regurgitation (MR), to examine the relationship between exercise-induced changes in MR and in systolic pulmonary artery pressure (PAP), and to identify their potential impact on symptom-free survival.

Background MR severity can change during exercise in patients with functional MR. Quantified changes in MR severity during exercise remain undetermined in patients with degenerative MR.

Methods Resting and bicycle exercise Doppler-echocardiography were performed in 61 asymptomatic patients (age 62 ± 14 years) with moderate to severe degenerative MR (i.e., mitral valve prolapse or flail). Mitral regurgitation was quantified at rest and exercise with effective regurgitant orifice (ERO) area and regurgitant volume calculated with the proximal isovelocity surface area (ERO_P) and the quantitative Doppler (ERO_D) methods.

Results At rest, ERO_P and ERO_D were well-correlated ($r = 0.87$, $p < 0.0001$), but ERO_D was larger than ERO_P (54 ± 21 mm^2 vs. 42 ± 24 mm^2, $p < 0.0001$). During exercise, mean ERO and regurgitant volume markedly increased in 32% of patients by ≥10 mm^2 and ≥15 ml, respectively. There was good correlation between exercise ERO_P and ERO_D ($r = 0.84$, $p < 0.0001$). Changes in systolic PAP were correlated with changes in ERO and regurgitant volume ($r = 0.59$, $p = 0.02$ and $r = 0.60$, $p = 0.02$). Patients with a marked increase in regurgitant volume during exercise had lower symptom-free survival than those in whom MR decreased or remained unchanged ($p = 0.0015$).

Conclusions Degenerative MR might be dynamic and increases during exercise in one-third of patients. Marked changes in MR severity are associated with exercise-induced changes in systolic PAP and reduced symptom-free survival.

Exercise-Induced Changes in Degenerative Mitral Regurgitation

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doi:10.1016/j.jacc.2009.12.073

Rest
ERO 42
RVol 68

========

Stop
100-125 W

Fc max
125±13

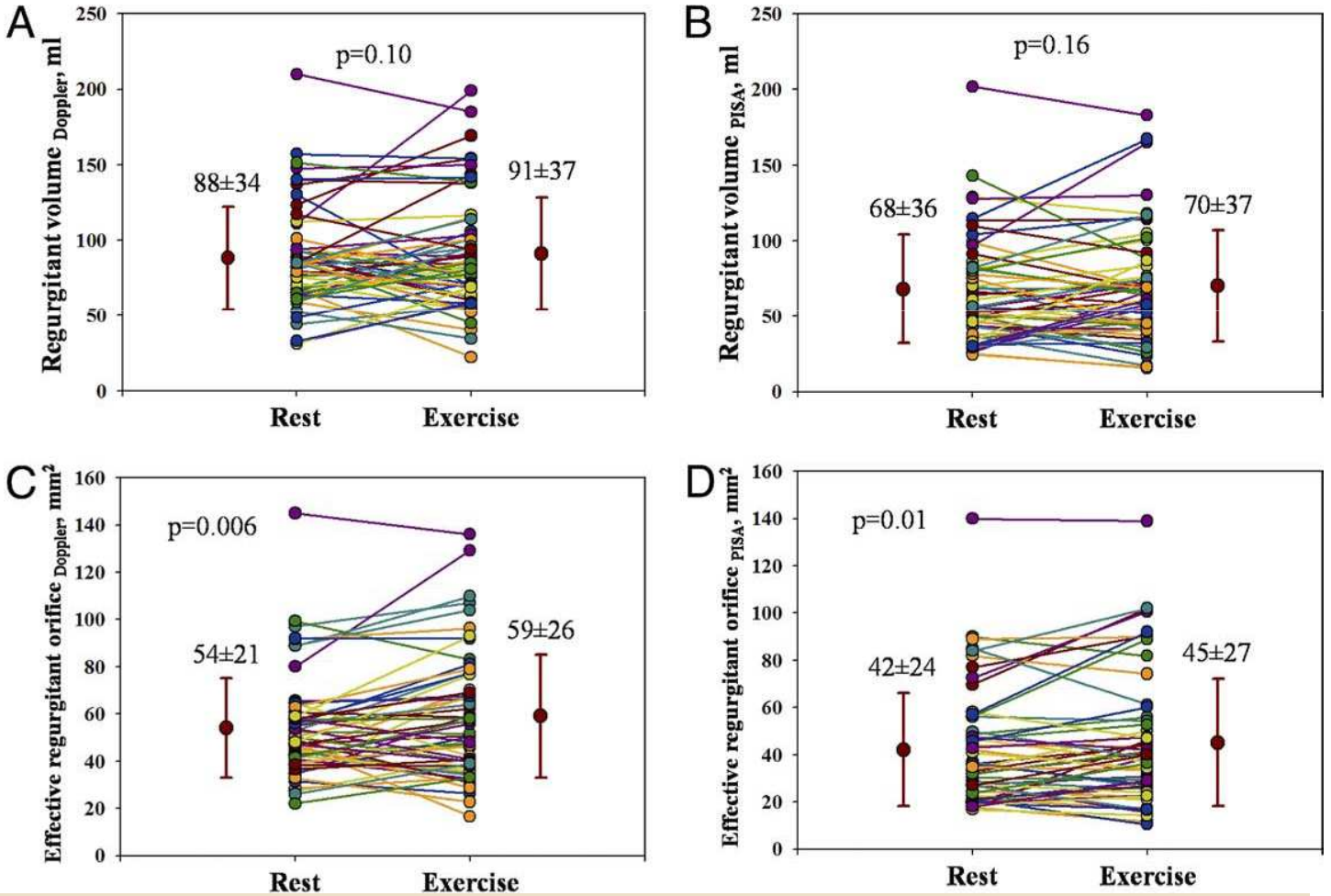

Figure 2 Individual Changes of Mitral Regurgitation Severity

Effective regurgitant orifice area and regurgitant volume according to Doppler volumetric method **(A, C)** and proximal isovelocity surface area (PISA) method **(B, D)**.

Exercise-Induced Changes in Degenerative Mitral Regurgitation

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Results

Exercise test. The mean exercise duration was 8.9 ± 2.3 min. Heart rate increased from 72 ± 11 beats/min at rest to 125 ± 13 beats/min during exercise ($p < 0.0001$). Systolic (from 136 ± 17 mm Hg to 178 ± 30 mm Hg) and diastolic blood pressures (from 76 ± 10 mm Hg to 83 ± 13 mm Hg) increased during exercise. During exercise, 1 patient developed atrial fibrillation, 6 had frequent premature beats, and 1 developed supraventricular tachycardia.

Stop a 100-125 W

Table 2 Resting and Exercise Echocardiographic Data

Variables	Rest	Exercise	p Value
LV geometry and function			
LV end-diastolic volume, ml	111 ± 35	104 ± 38	0.0009
LV end-systolic volume, ml	34.5 ± 12	30 ± 15	0.0013
LV ejection fraction, %	69 ± 6	71 ± 10	0.04
Mitral E-wave velocity, cm/s	96 ± 32	134 ± 42	<0.0001
E/A ratio	1.5 ± 0.6	1.5 ± 0.4	0.5
E/Ea ratio	13.9 ± 5.7	14.6 ± 5.4	0.15
Heart rate, beats/min	71 ± 11	125 ± 13	<0.0001
LV stroke volume, ml	81 ± 23	85 ± 23	0.024
Mitral regurgitation severity			
Effective regurgitant orifice area, mm^2	48 ± 14	53 ± 20	0.002
Regurgitant volume, ml	77 ± 22	81 ± 31	0.09
LA volume, ml	68 ± 24	78 ± 30	0.0015
Peak transtricuspid pressure gradient, mm Hg	30 ± 10	55 ± 18	<0.0001

Values are mean ± SD or n (%).
LA = left atrial; LV = left ventricular.

Exercise-Induced Changes in Degenerative Mitral Regurgitation

IM "degenerativa"

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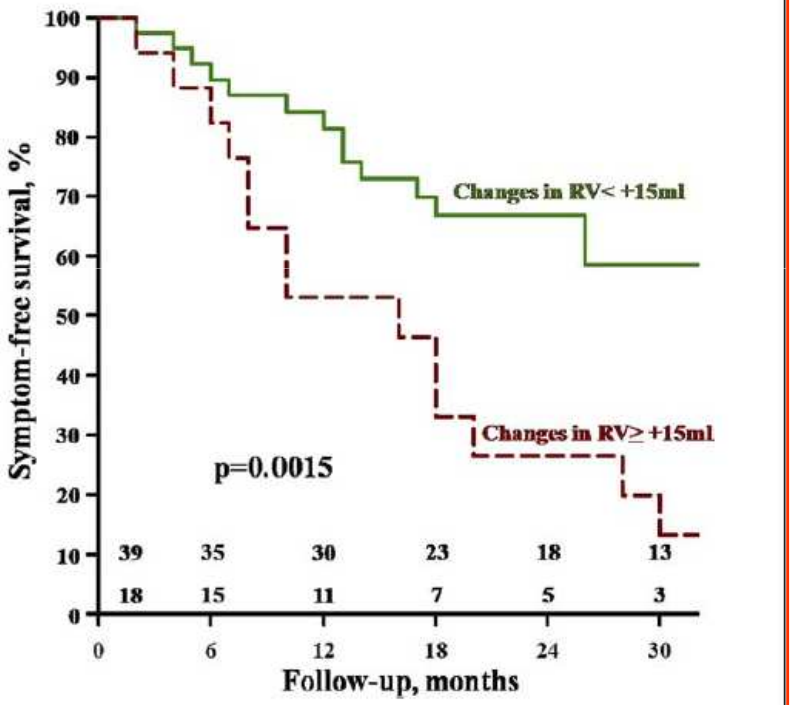


Figure 6 Symptom-Free Survival

Symptom-free survival of patients with marked exercise-induced increase in RV (≥+15 ml) compared with those with marked decrease (≥−15 ml) or no marked change (<+15 ml and >−15 ml). Abbreviations as in Figure 3.

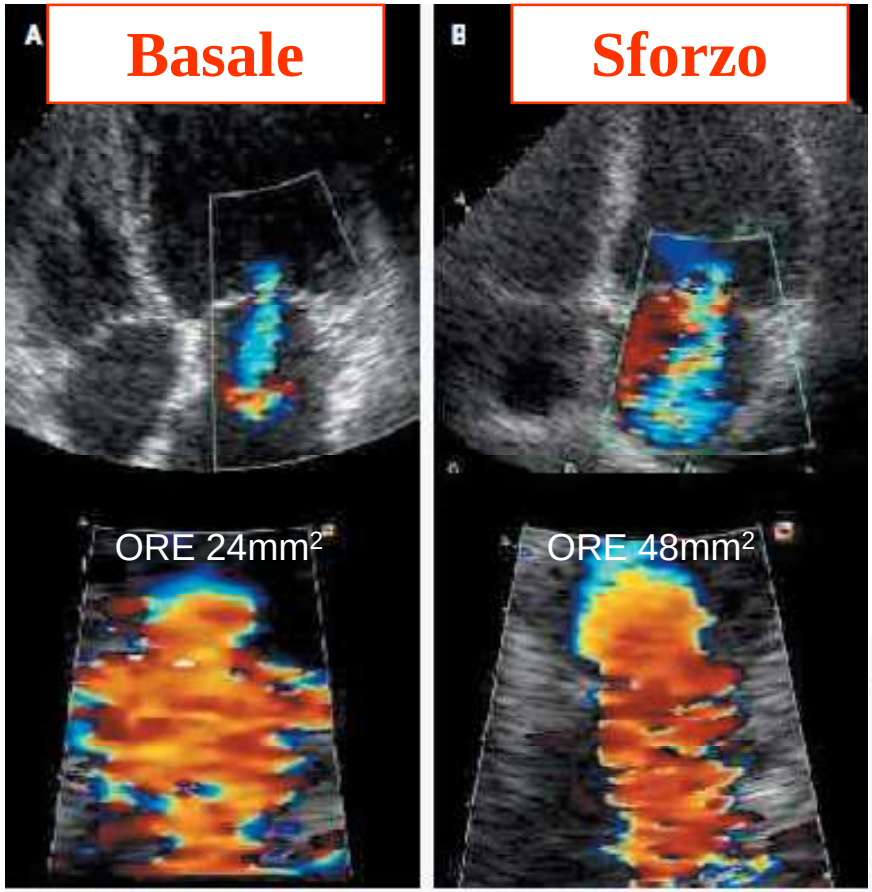
Exercise test. The mean exercise duration was 8.9 ± 2.3 min. Heart rate increased from 72 ± 11 beats/min at rest to 125 ± 13 beats/min during exercise ($p < 0.0001$). Systolic (from 136 ± 17 mm Hg to 178 ± 30 mm Hg) and diastolic blood pressures (from 76 ± 10 mm Hg to 83 ± 13 mm Hg) increased during exercise. During exercise, 1 patient developed atrial fibrillation, 6 had frequent premature beats, and 1 developed supraventricular tachycardia.

Of the 61 patients, 10 (16%) developed dyspnea at peak exercise with the need to stop exercise. The 51 remaining patients reached the predicted target heart rate (n = 14, 23%) or stopped the test because of fatigue or leg discomfort (n = 37, 61%).

Eco da sforzo nell'**insufficienza mitralica**: sintomi, entità rigurgito, meccanismo rigurgito, VS, PAPs

- Fattibilità e criteri di valutazione e quantificazione
- Informazioni diagnostiche
- Valore prognostico
- Decisioni terapeutiche

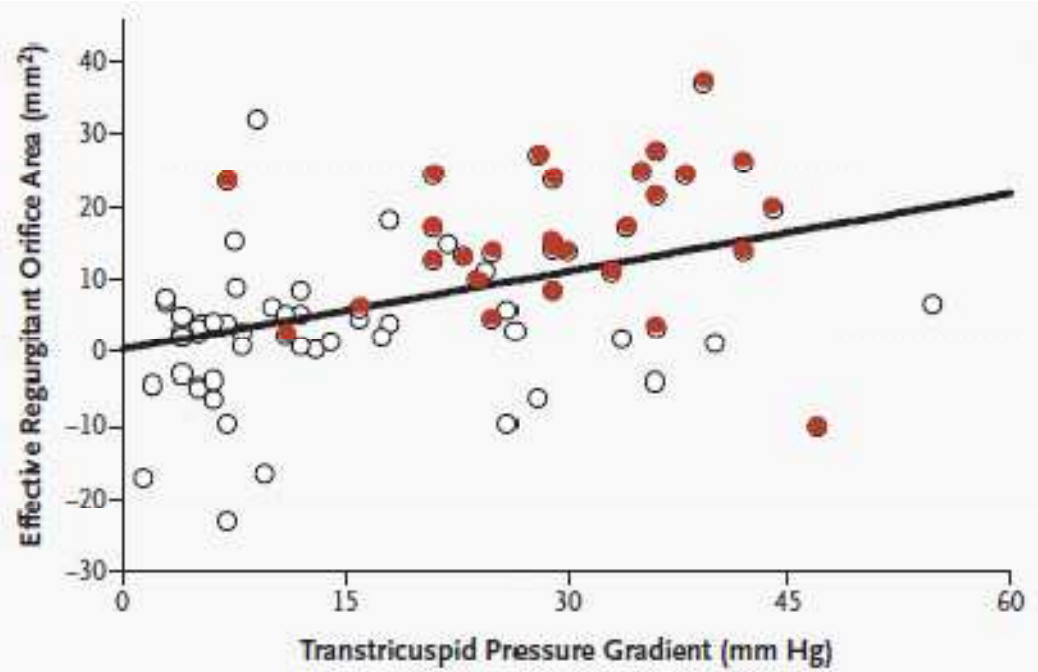
EPA non giustificabile dalla valutazione ecocardiografica a riposo



Pierard NEJM' 04

Variabili le cui variazioni durante esercizio sono risultate predittive di "EPA recente ":

1. **EROA**
2. **Gradiente del rigurgito tricuspidale**



SINTOMATICI con IM NON SEVERA a RIPOSO

- **Entità rigurgito**
- **Stima PAPs**

ACCF/ASE/ACEP/AHA/ASNC/SCAI/SCCT/SCMR 2008 Appropriateness Criteria for Stress Echocardiography*

A Report of the American College of Cardiology Foundation Appropriateness Criteria Task Force, American Society of Echocardiography, American College of Emergency Physicians, American Heart Association, American Society of Nuclear Cardiology, Society for Cardiovascular Angiography and Interventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance

Score di appropriatezza: 1-9

Table 9. Stress Study for Hemodynamics (Includes Doppler During Stress)

• Asymptomatic severe AI or MR • LV size and function not meeting surgical criteria	A (7)
• Severe AI or MR • Symptomatic or with severe LV enlargement or LV systolic dysfunction	I (2)

ASINTOMATICI con IM di grado SEVERO, se NON sono presenti i criteri chirurgici di dilatazione e disfunzione ventricolare

NESSUNA DISTINZIONE TRA FORME ORGANICHE E FUNZIONALI

Eco da sforzo nell'**insufficienza mitralica**: sintomi, entità rigurgito, meccanismo rigurgito, VS, PAPs

- Fattibilità e criteri di valutazione e quantificazione
- Informazioni diagnostiche
- Valore prognostico
- Decisioni terapeutiche

European Association of Echocardiography recommendations for the assessment of valvular regurgitation. Part 2: mitral and tricuspid regurgitation (native valve disease)

Key point

Exercise echocardiography is useful in patients with functional ischaemic MR and chronic LV systolic dysfunction to unmask the dynamic behaviour of MR. Patients with an increase in EROA by $\geq 13\ mm^2$ are patients at increased risk of cardiovascular events. In these patients, exercise echocardiography also helps to identify the presence and extent of viable myocardium at jeopardy.

EUROPEAN SOCIETY OF CARDIOLOGY®

European Journal of Echocardiography (2010) **11**, 307–332
doi:10.1093/ejechocard/jeq031

RECOMMENDATIONS

European Heart Journal (2007) **28**, 230–268
doi:10.1093/eurheartj/ehl428

Guidelines on the management of valvular heart disease

The Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology

Exercise echocardiography

Promising recent reports suggest that the estimation of the prognosis of VHD and indications for intervention may be refined by measuring changes in gradients or degree of regurgitation on exercise.[24,25] Echocardiography performed immediately after exercise has shown to be useful to assess the prognosis of degenerative MR.[26]

Linee guida sulle Valvulopatie

European Heart Journal (2007) **28**, 230–268
doi:10.1093/eurheartj/ehl428

ESC Guidelines

Guidelines on the management of valvular heart disease

The Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology

Studi preliminari: la quantificazione del rigurgito mitralico durante esercizio

1) è fattibile
2) fornisce informazioni sulle caratteristiche dinamiche
3) ha valore prognostico

Bibliografia

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European Heart Journal (2007) **28**, 230–268
doi:10.1093/eurheartj/ehl428

ESC Guidelines

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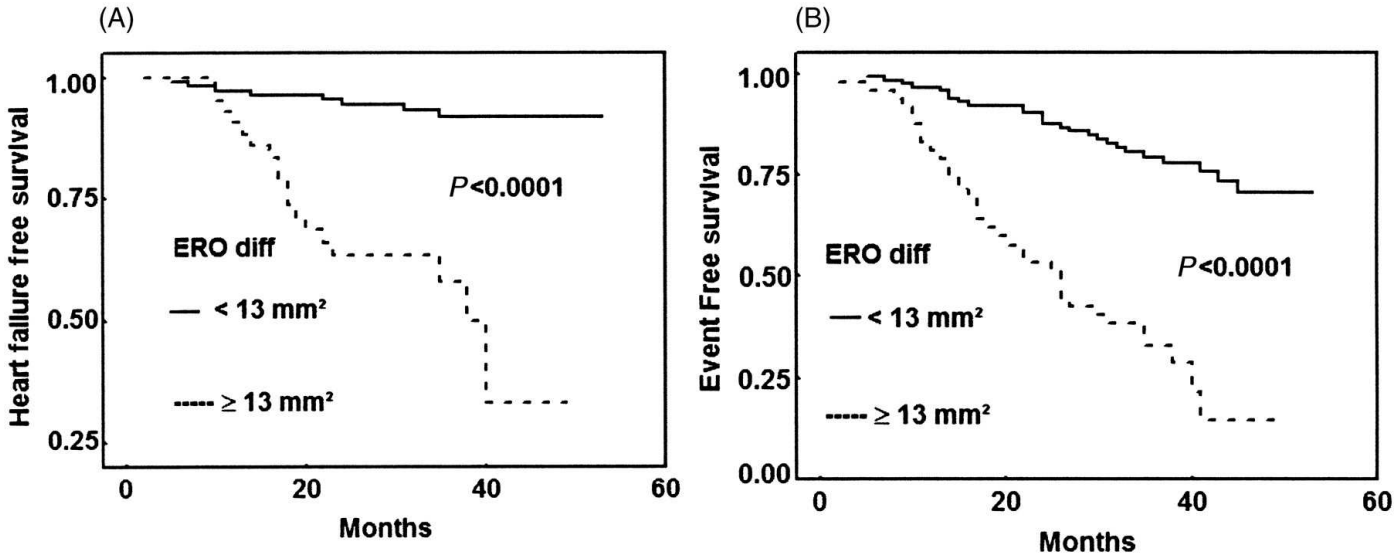
Promising recent reports suggest that the estimation of the prognosis of VHD and indications for intervention may be refined by measuring changes in gradients or degree of regurgitation on exercise.[24,25] Echocardiography performed immediately after exercise has shown to be useful to assess the prognosis of degenerative MR.[26] However, these preliminary findings need to be confirmed before this can be recommended in practice.

"Il valore prognostico del test da sforzo rispetto al risultato chirurgico necessita di essere verificato"

(A) Proportion of patients without admission for heart failure and (B) without major adverse cardiac events, according to exercise-induced differences in effective regurgitant orifice area of mitral regurgitation

IM "funzionale"



Lancellotti, P. et al. Eur Heart J 2005 26:1528-1532; doi:10.1093/eurheartj/ehi189

European Heart Journal

Il valore prognostico

Alcuni studi hanno studiato il **valore prognostico** del comportamento del rigurgito mitralico in pazienti con cardiopatia (ischemica o non ischemica)

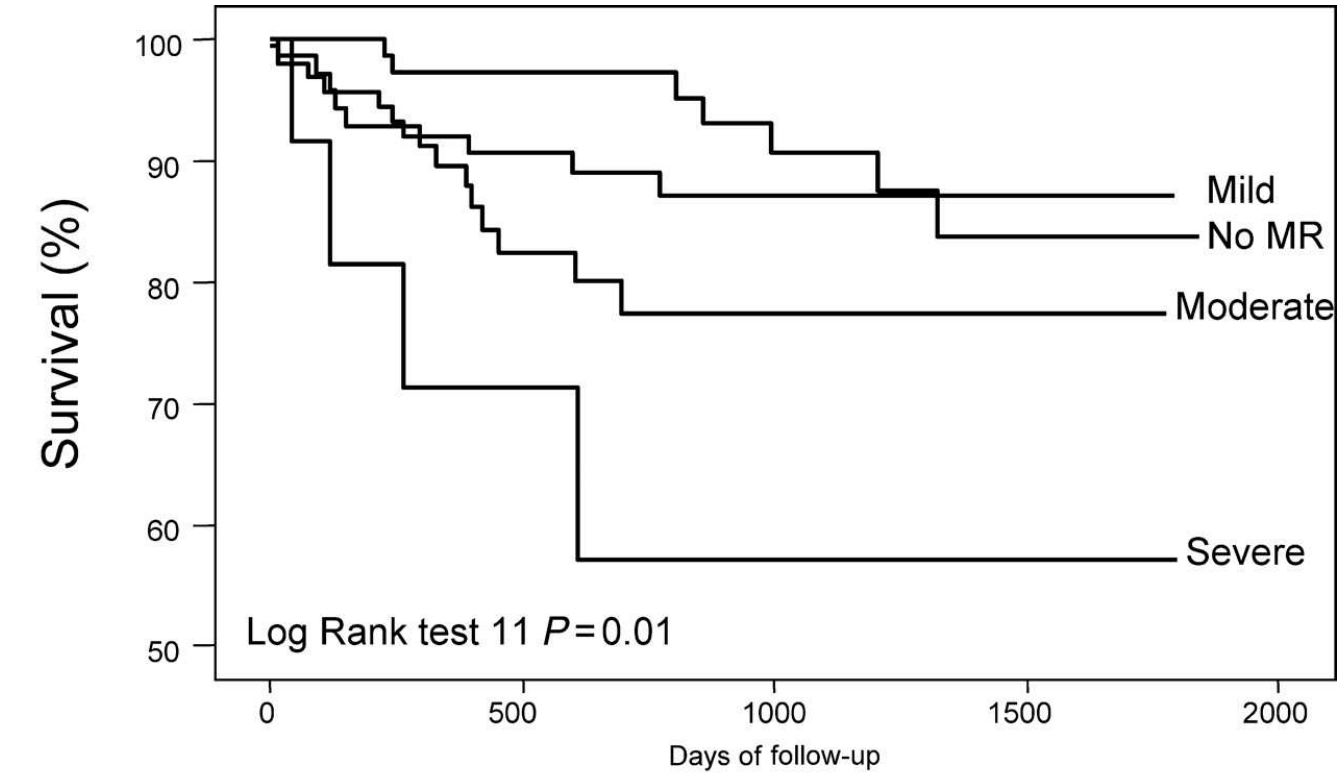
- Long-term outcome of patients with heart failure and dynamic functional mitral regurgitation. *Patrizio Lancellotti* , Paul L. G*érard*, and *Luc A. Piérard*

- Rest and stress echocardiographic predictors of prognosis in patients with left ventricular dysfunction and functional mitral regurgitation. Eustachio Agricola et al. International Journal of Cardiology 124 (2008) 247–249

- Exercise does not enhance the prognostic value of Doppler echocardiography in patients with left ventricular systolic dysfunction and functional mitral regurgitation at rest. *Pierre V. Ennezat Am Heart J 2008;155:752-7*

«Il valore prognostico del test da sforzo rispetto al risultato chirurgico necessita di essere verificato»

Kaplan-Meier survival curves of patients with no, mild, moderate and severe mitral regurgitation at rest



No MR	118	58	39	16
Mild	108	59	26	4
Moderate	84	38	16	3
Severe	13	6	3	1

Patients at risk

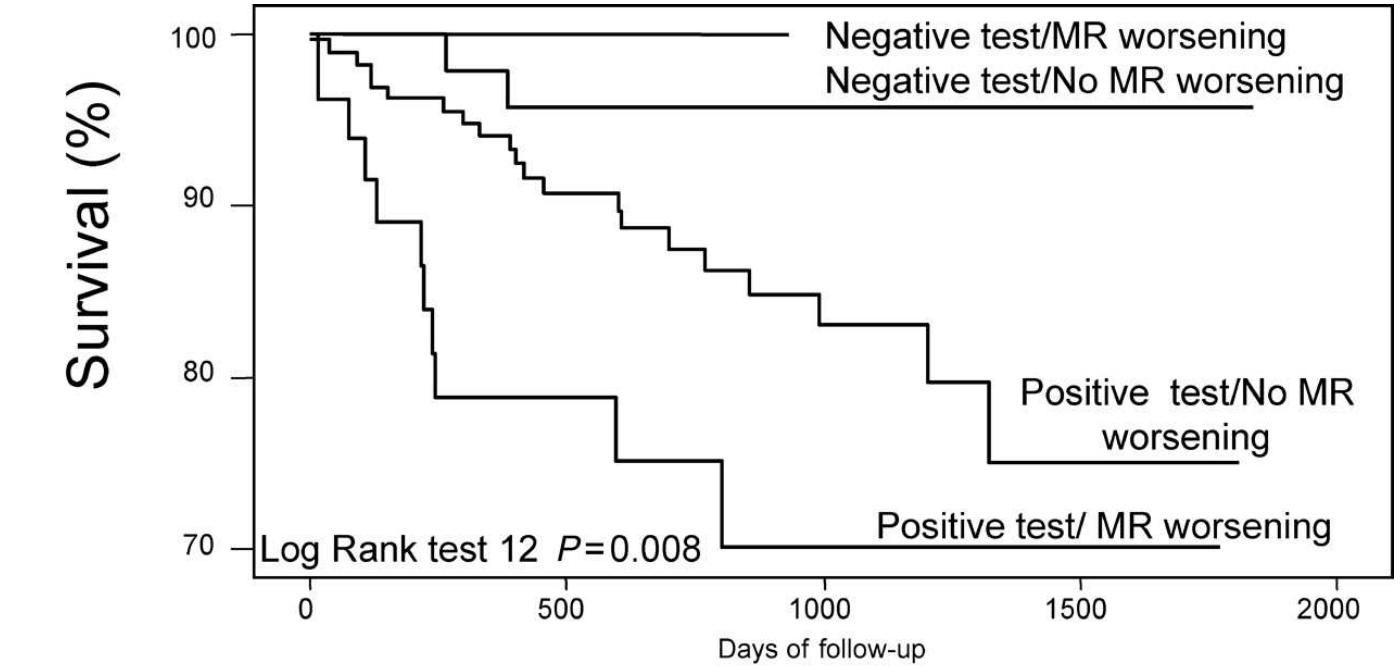
Peteiro, J. et al. Eur J Echocardiogr 2008 9:18-25; doi:10.1016/j.euje.2006.11.013

PROGNOSI IM A RIPOSO

European Journal of Echocardiography

Kaplan-Meier survival curves of patients classified according to the EE result and increase in MR grade from rest to post-exercise

IM "funzionale"



Patients at risk				
Negative/ No MR worsening	55	41	25	9
Negative/ MR worsening	4	2	0	0
Positive/ No MR worsening	201	95	48	9
Positive/ MR worsening	63	22	11	6

Peteiro, J. et al. Eur J Echocardiogr 2008 9:18-25; doi:10.1016/j.euje.2006.11.013

PROGNOSI IM DOPO SFORZO

European Journal of Echocardiography

Exercise Pulmonary Hypertension in Asymptomatic Degenerative Mitral Regurgitation

Julien Magne, PhD; Patrizio Lancellotti, MD, PhD, FESC; Luc A. Piérard, MD, PhD, FESC

Background—Current guidelines recommend mitral valve surgery for asymptomatic patients with severe degenerative

78 pazienti asintomatici
IM di grado moderato/severo
Ipertensione polmonare da esercizio nel 46%, correlata con ERO

L'Ipertensione polmonare da esercizio è risultata più accurata nel predire la sopravvivenza a 2 anni libera da eventi

>56 mm Hg) was more accurate than resting PHT (SPAP >36 mm Hg) in predicting the occurrence of symptoms during follow-up (P=0.032).

Conclusions—Exercise PHT is frequent in patients with asymptomatic degenerative mitral regurgitation. Exercise mitral regurgitation severity is a strong independent predictor of both exercise SPAP and exercise PHT. Exercise PHT is associated with markedly low 2-year symptom-free survival, emphasizing the use of exercise echocardiography. An exercise SPAP >56 mm Hg accurately predicts the occurrence of symptoms. (***Circulation*.** **2010;122:33-41.**)

Exercise Pulmonary Hypertension in Asymptomatic Degenerative Mitral Regurgitation

Julien Magne, PhD; Patrizio Lancellotti, MD, PhD, FESC; Luc A. Piérard, MD, PhD, FESC

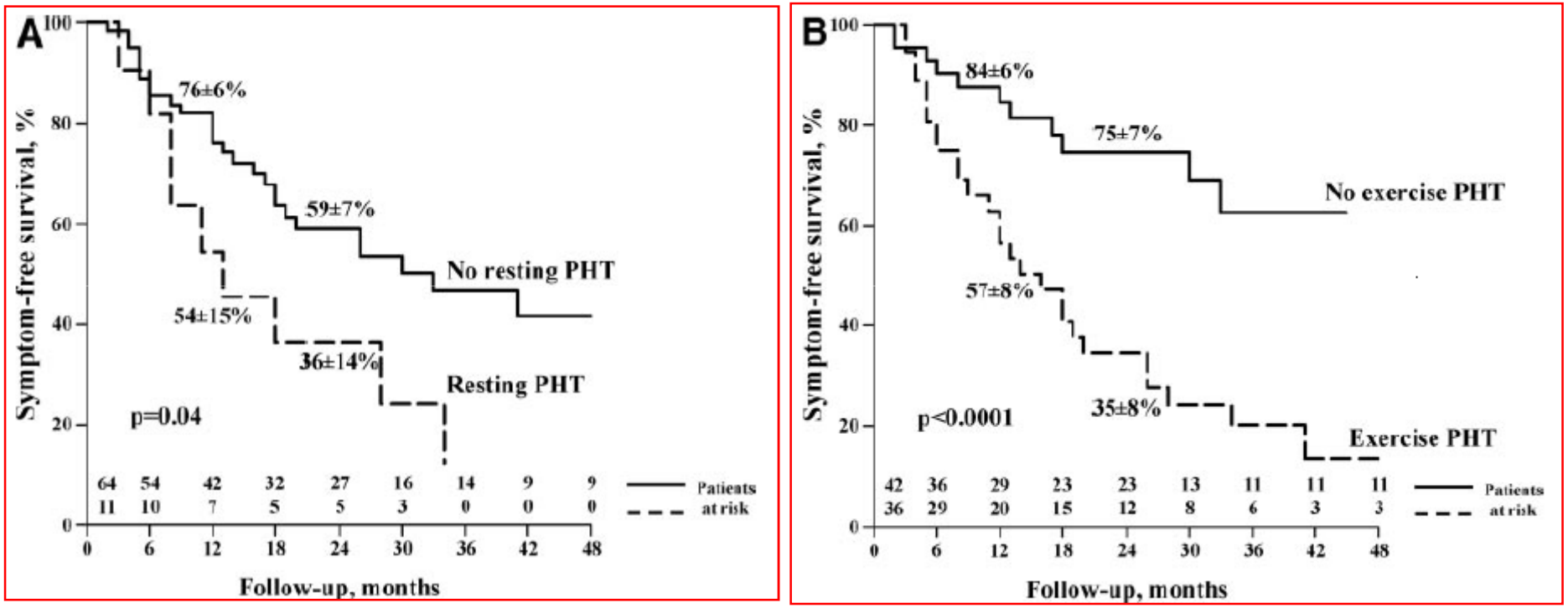


Figure 2. Symptom-free survival according to resting (A) and exercise (B) PHT.

Circulation **2010;122:33-41**

Eco da sforzo nell'**insufficienza mitralica**: sintomi, entità rigurgito, meccanismo rigurgito, VS, PAPs

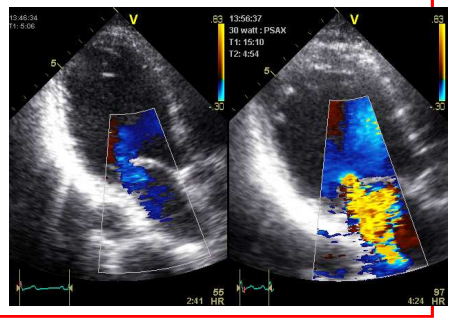
- Fattibilità e criteri di valutazione e quantificazione
- Informazioni diagnostiche
- Valore prognostico

- Decisioni terapeutiche

  chirurgia?

  risincronizzazione?

  terapia medica?



Caso 1 – Cardiopatia ischemica
Asintomatico con ridotta attività fisica - IM moderata-severa

- **Pregresso IMA inferiore**
- **Agosto 2008 IMA anteriore e shock cardiogeno**
- **PTCA su IVA**
- **Rimodellamento ventricolare precoce, IM di grado severo dopo pochi giorni**
- **Massimizzazione terapia medica**

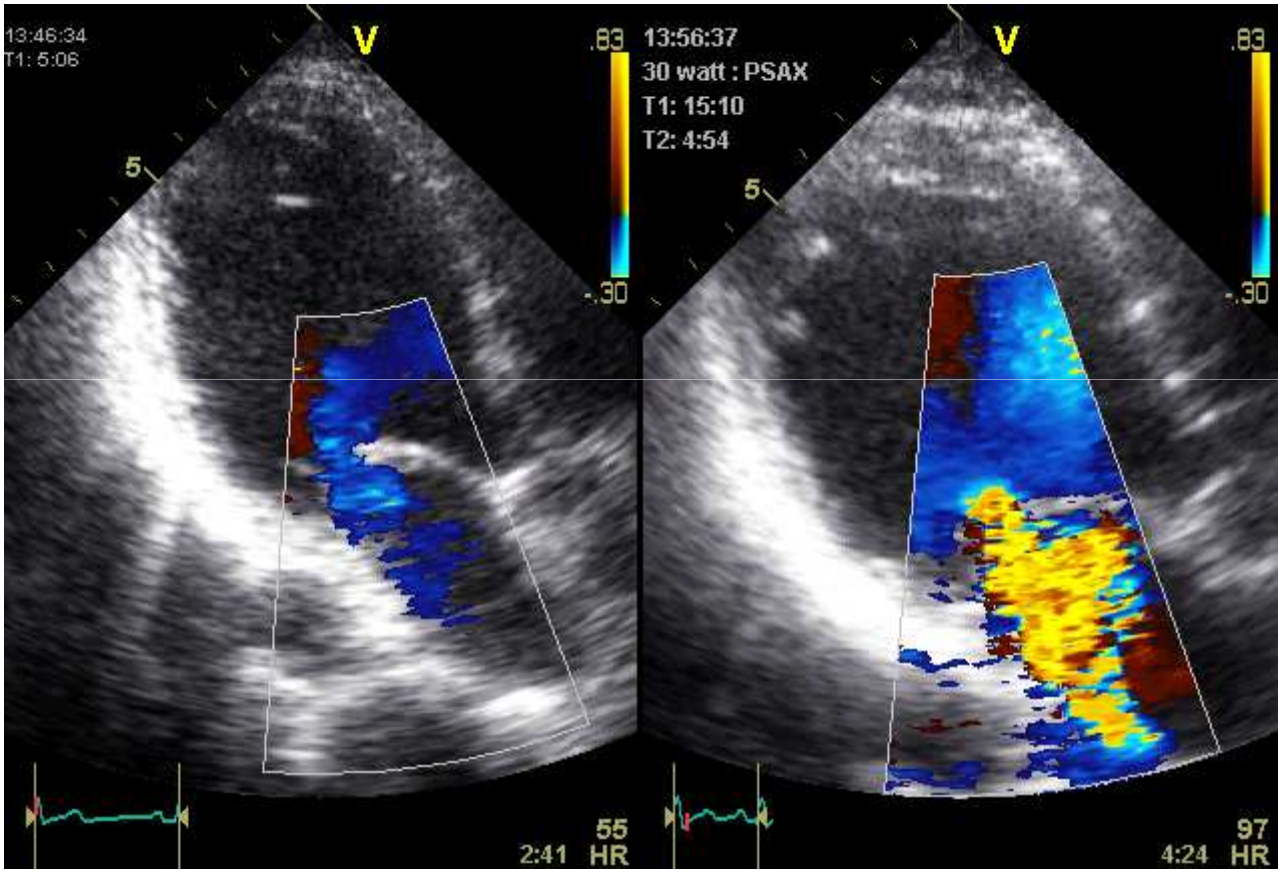
Follow up clinico ed ecocardiografico (x12 mesi):

- **Persistenza di disfunzione VS e IM di grado moderato-severo**
- **Asintomatico, ridotta attività fisica**

Caso 1 – Cardiopatia ischemica (pregresso IMA inferiore, poi IMA anteriore). ASINTOMATICO con ridotta attività fisica

Basale 55 bpm **30 watt 98 bpm**

EROA 23 mm2



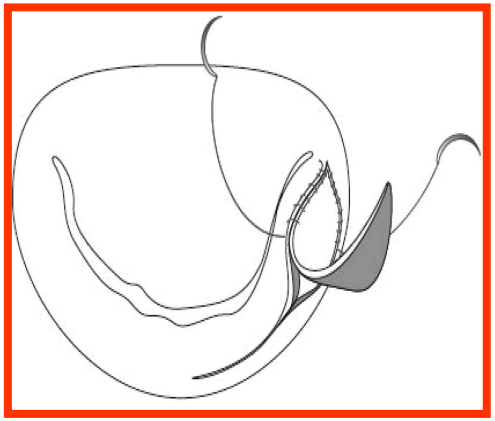
EROA 37 mm2

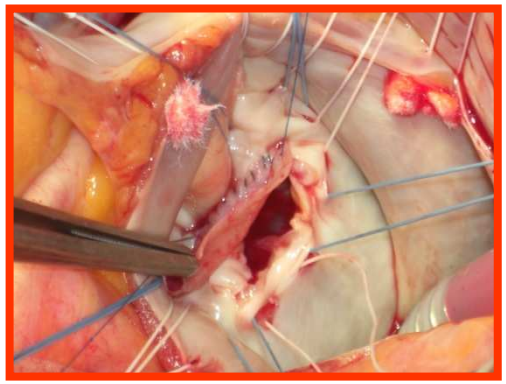
Ecocardiogramma da sforzo: Funzione VS invariata, stop per dispnea, marcato incremento del rigurgito

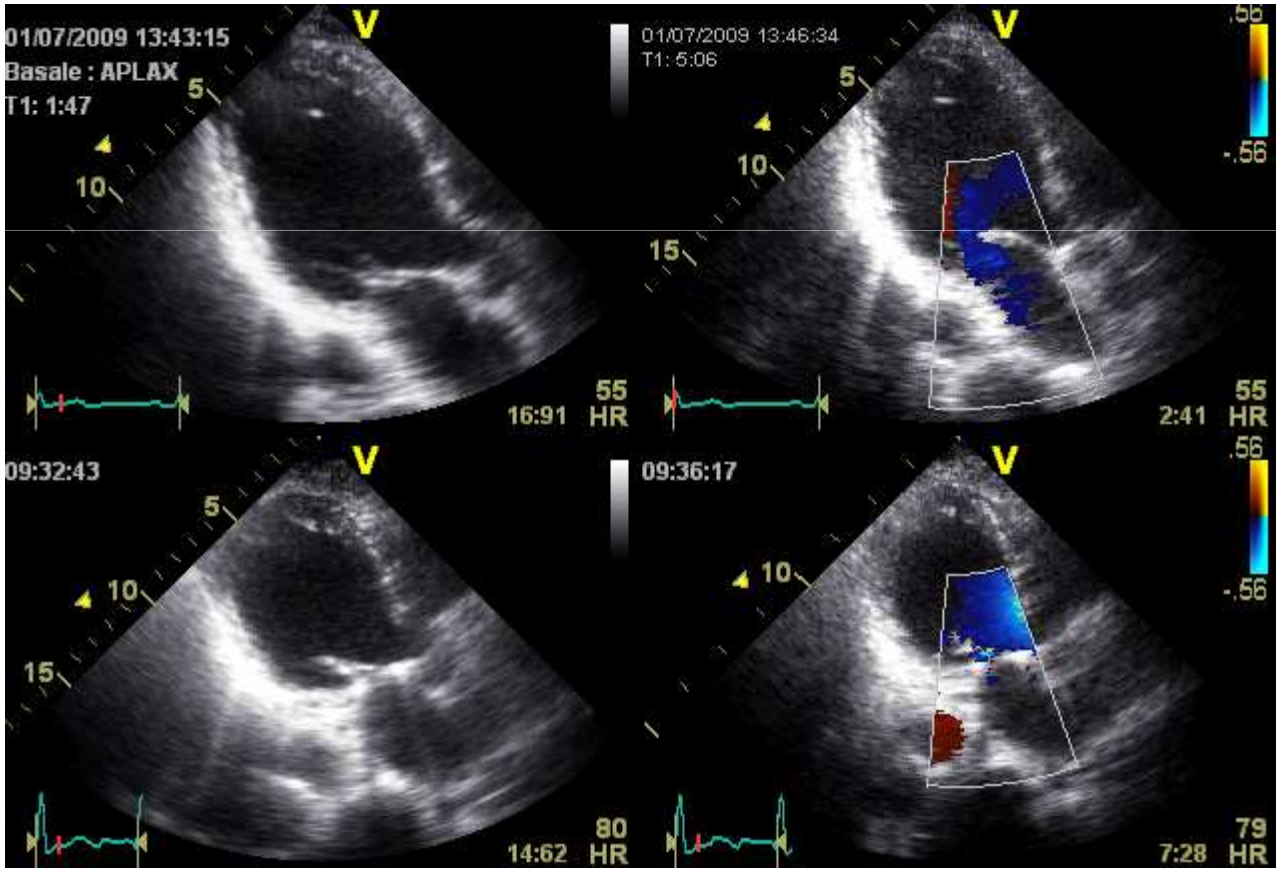
Caso 1 TRATTAMENTO CHIRURGICO

Coronarografia di controllo: pervietà di pregressa PTCA su IVA

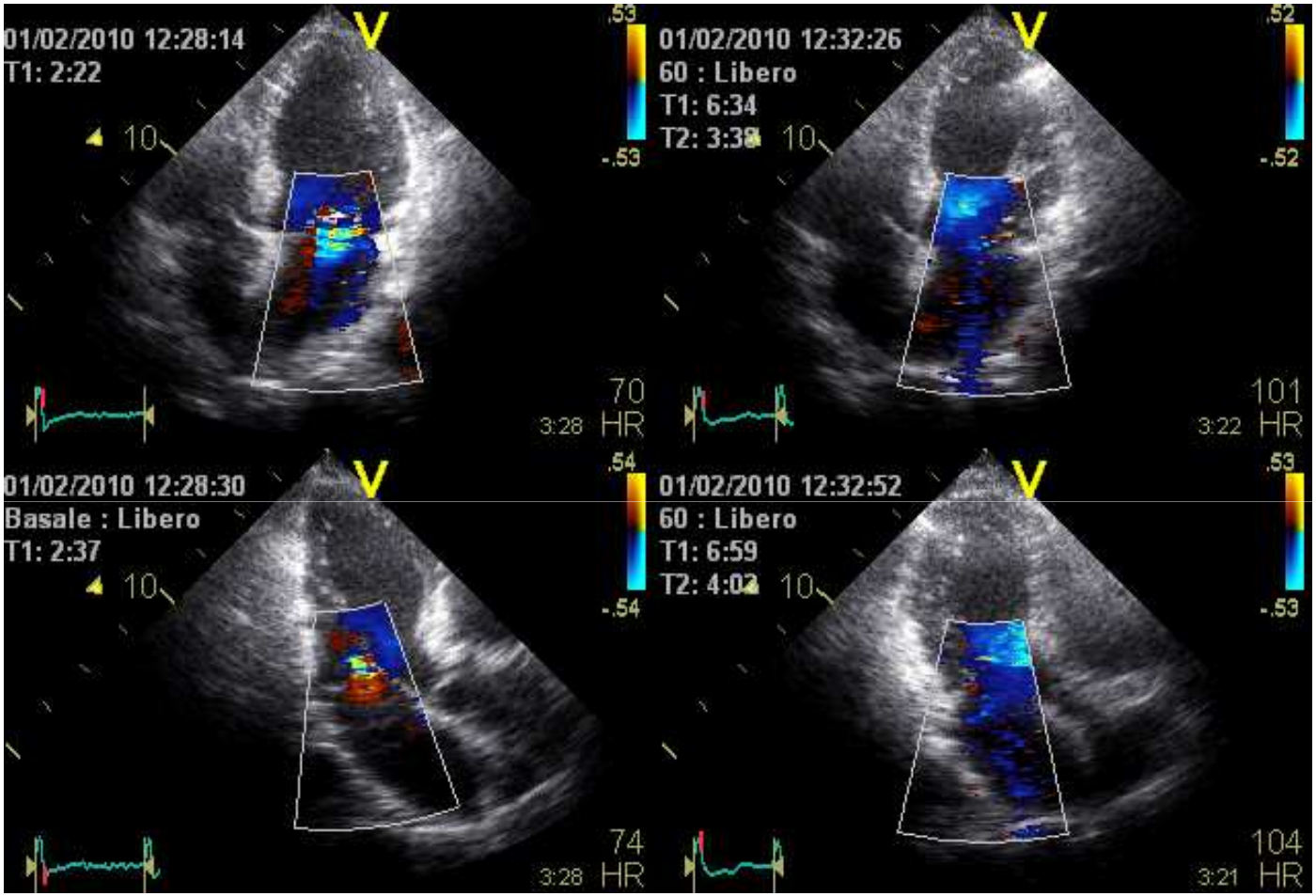
Ampliamento del lembo posteriore mitralico con patch di pericardio autologo + anello completo







Caso 2 ASINTOMATICO ridotta attività fisica
Pregresso IMA laterale

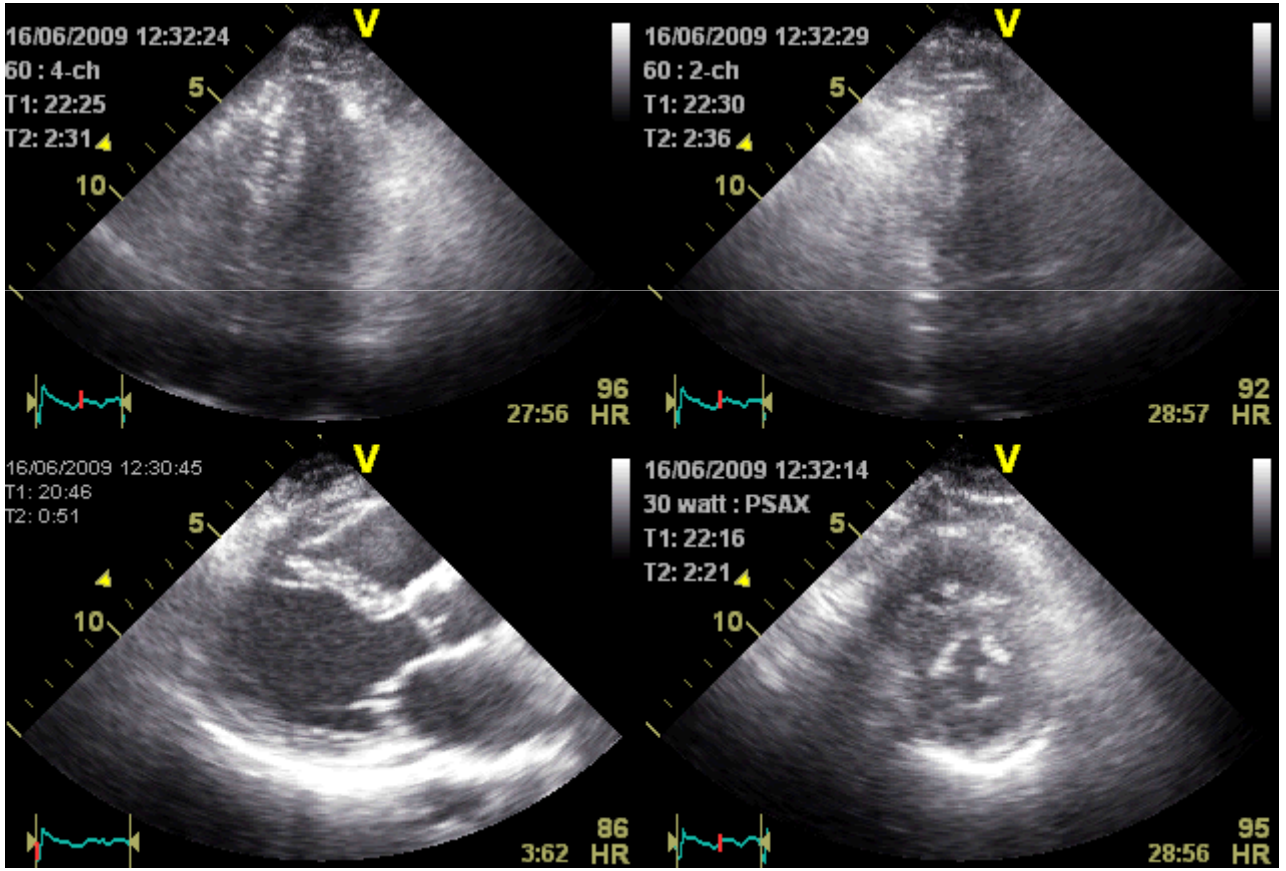


Asintomatico, Non ischemia inducibile in terapia
Non incremento del rigurgito, Non ipertensione polmonare
Prosecuzione con terapia medica

Caso 3 - Dispnea da sforzo a bassa soglia, 2 accessi a PS per scompenso acuto
IMA ANT - PTCA IVA
STENOSI MAX CDX E CX 40-60%

Esercizio 60 watt 91 bpm

AP 4c



AP 2c

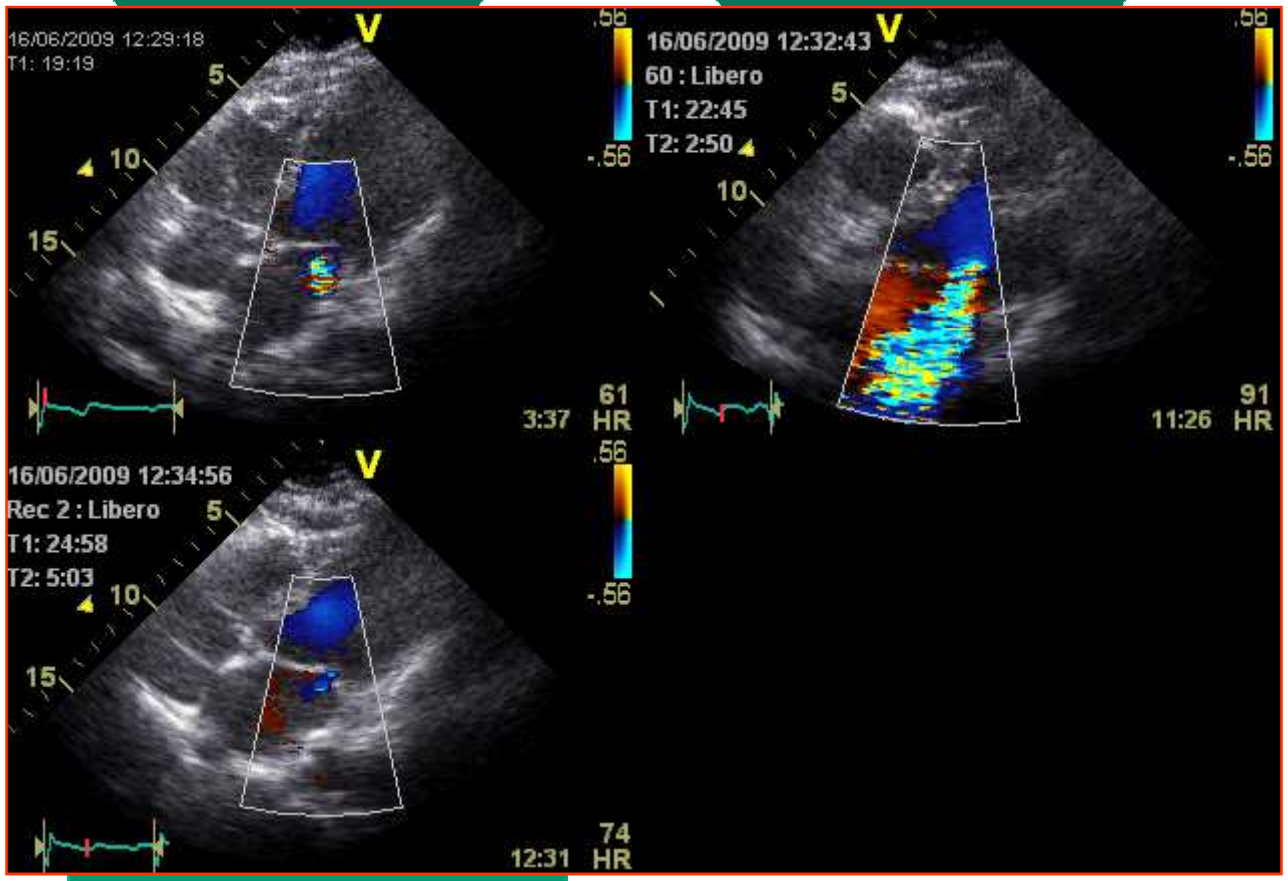
PLAX

PSAX

Caso 3 - Dispnea da sforzo a bassa soglia, 2 accessi a PS per scompenso acuto
IMA ANT - PTCA IVA
STENOSI MAX CDX E CX 40-60%

Basale 61 bpm

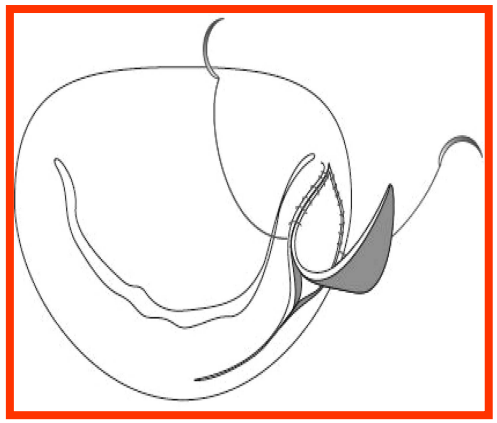
60 watts 91 bpm

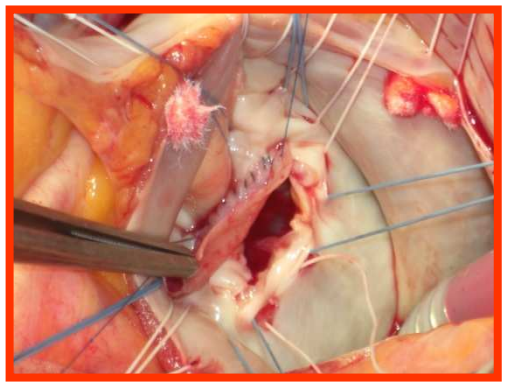


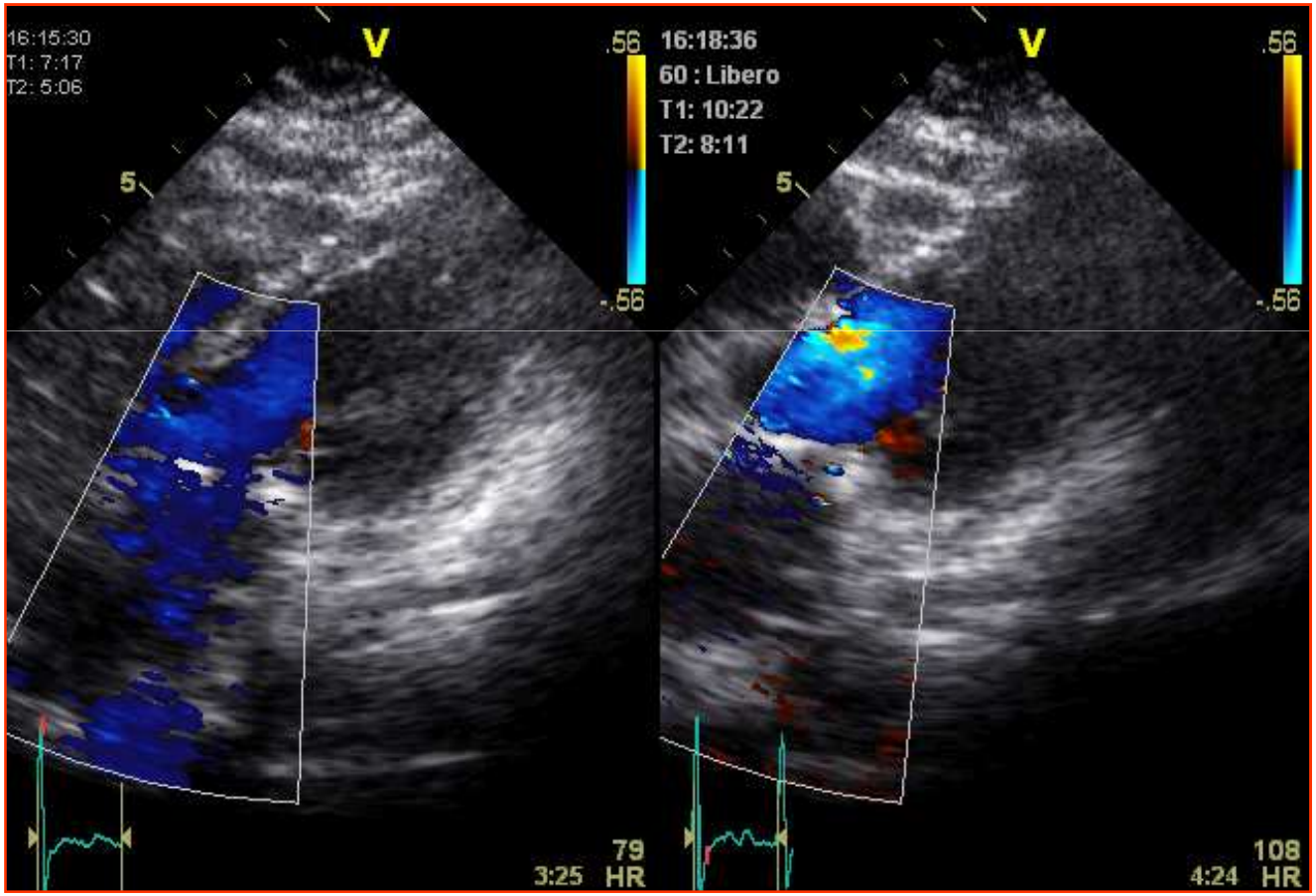
2’ Recupero 74 bpm

Caso 3 TRATTAMENTO CHIRURGICO

Ampliamento del lembo posteriore mitralico con patch di pericardio autologo + anello completo



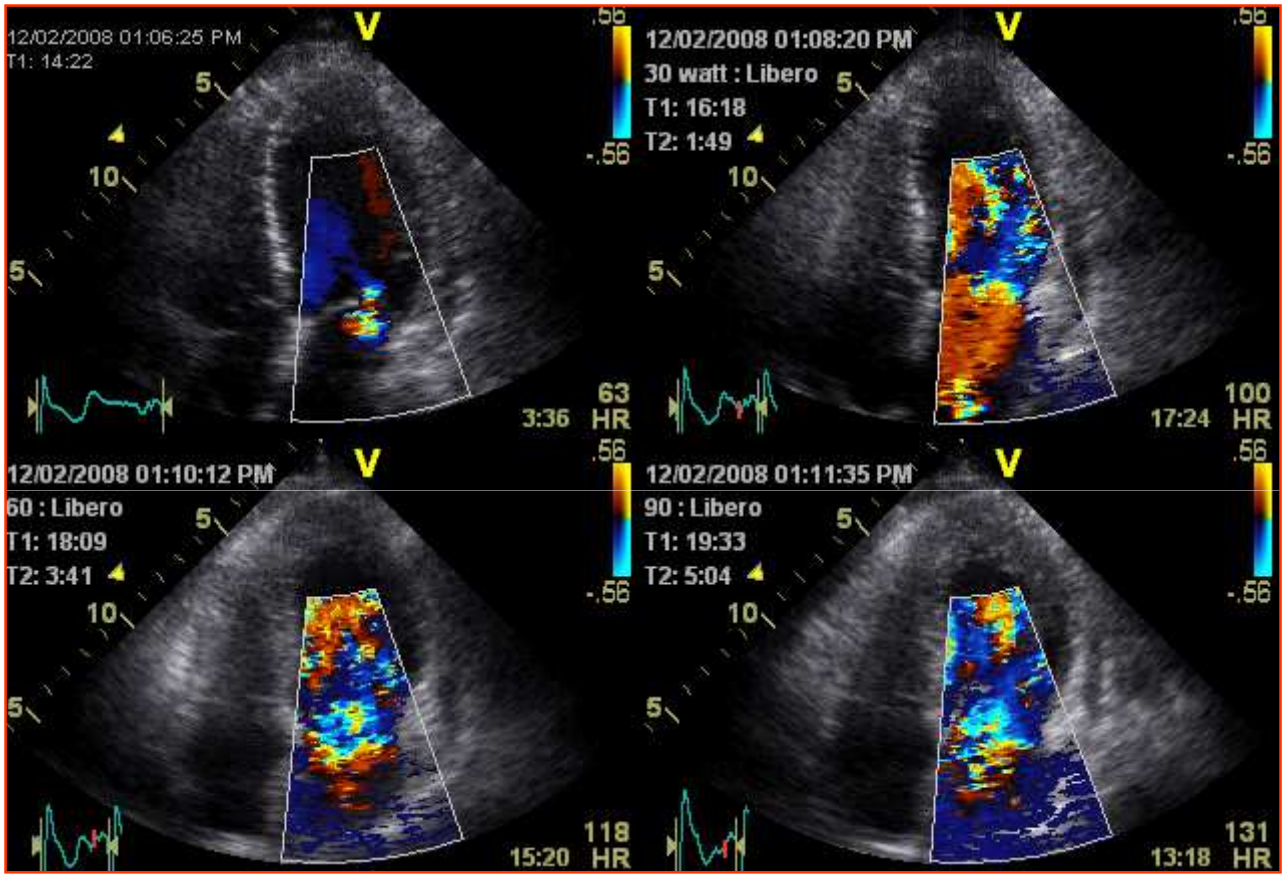




Basale post-op

Sforzo 60 watts 108 bpm

Caso 4 DISPNEA DA SFORZO – ISCHEMIA+IM
Pregressa PTCA+STENT su MO per IMA laterale



In questo caso il netto incremento dell'IM *è già visibile a 30 watt* prima delle alterazioni di cinetica ventricolare, evidenti solo a 90 watt

Cardiac resynchronisation therapy reduces functional mitral regurgitation during dynamic exercise in patients with chronic heart failure: an acute echocardiographic study

P-V Ennezat, B Gal, C Kouakam, C Marquie, T LeTourneau, D Klug, D Lacroix, D Logeart, A Cohen-Solal, S Dennetière, E Van Belle, G Deklunder, P Asseman, P de Groote, S Kacet, T H LeJemtel

5.071654

La terapia di risincronizzazione cardiaca riduce l'insufficienza mitralica funzionale da sforzo

(CRT) on

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See end of article fc
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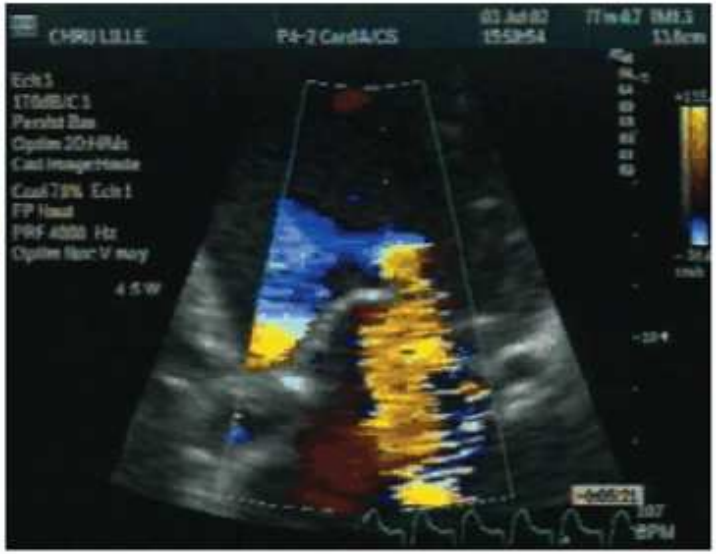
exercise was performed without CRT. Mitral regurgitant flow volume (RV), effective regurgitant orifice area (ERO) and LV dP/dt were measured at rest and at peak exercise.
Results: CRT mildly reduced resting mitral ERO (mean 8 (SEM 2) *v* 11 (2) mm^2 without CRT, $p = 0.02$) and RV (13 (3) *v* 18 (3) ml without CRT, $p = 0.03$). CRT attenuated the spontaneous increase in mitral ERO and RV during exercise (1 (1) *v* 9 (2) mm^2, $p = 0.004$ and 1 (1) *v* 8 (2) ml, $p = 0.004$, respectively). CRT also significantly increased exercise-induced changes in LV dP/dt (140 (46) *v* 479 (112) mm Hg/s, $p < 0.001$).
Conclusion: Attenuation of functional MR, induced by an increase in LV contractility during dynamic exercise, may contribute to the beneficial clinical outcome of CRT in patients with chronic heart failure and LV asynchrony.

With CRT

Without CRT

ERO
13 mm^2

RV
21 ml

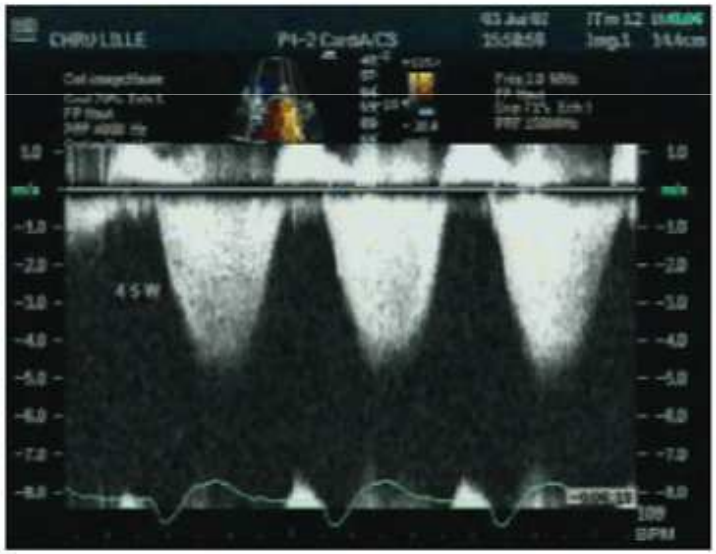


ERO
35 mm^2

RV
34 ml

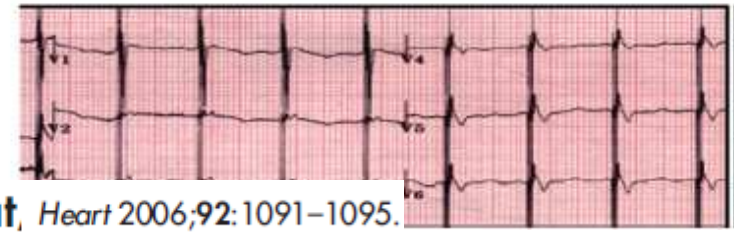
LV +dP/dt
1067 mm Hg/s

MR Vmax
530 cm/s



LV +dP/dt
356 mm Hg/s

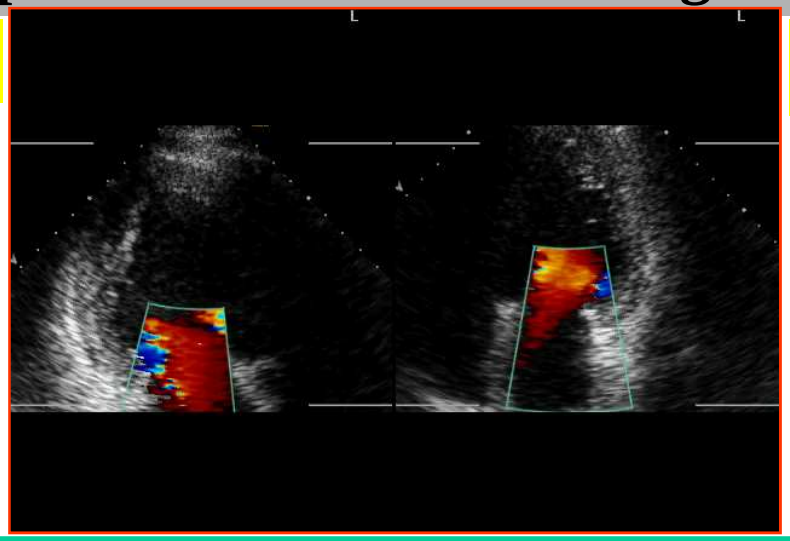
MR Vmax
470 cm/s



P-V Ennezat, *Heart* 2006;**92**:1091–1095.

Caso 5 CMD IDIOPATICA, BBS, FE 38%
Dispnea da sforzo a bassa soglia fissa

Eco sforzo Pre CRT

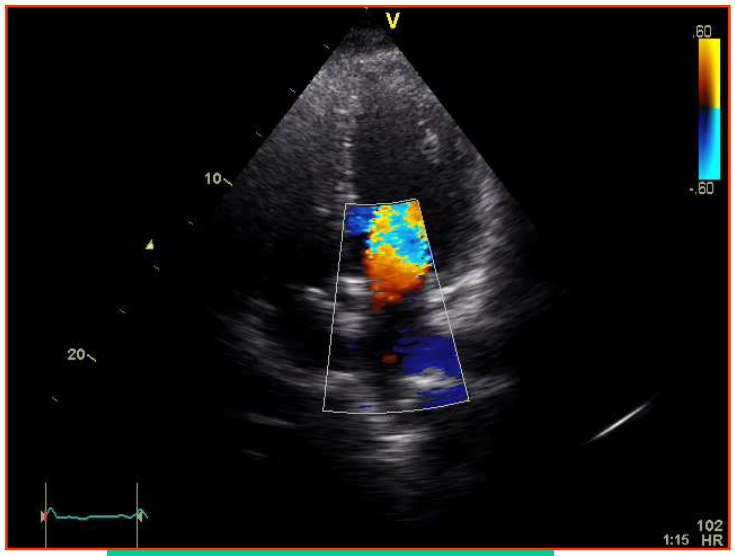


Dispnea

Sforzo 30w
95 bpm

Recupero
70 bpm

Eco sforzo post CRT: Asintomatico 90 watts, 125 bpm

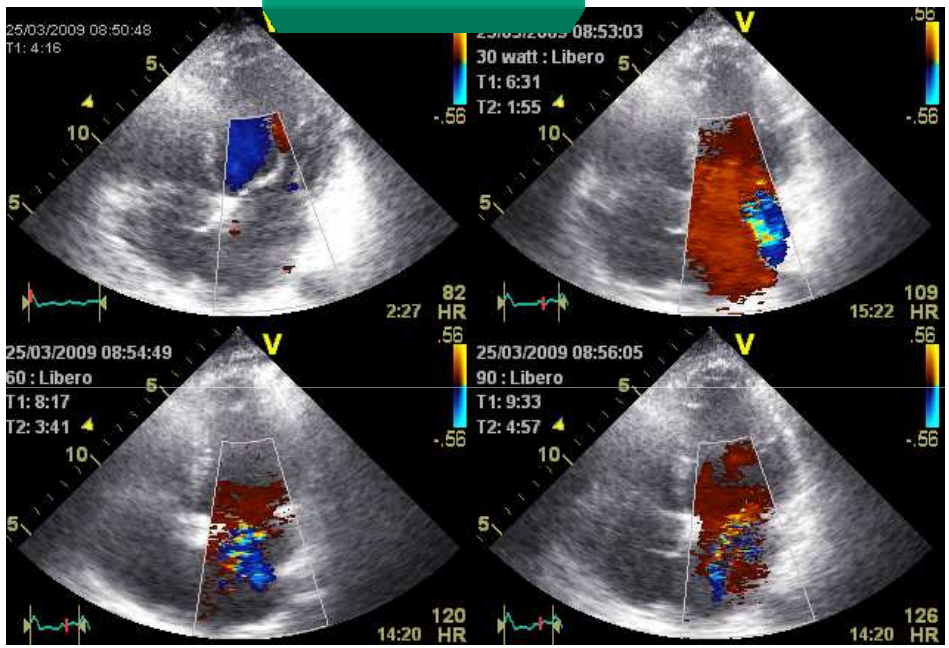


60 watts 102 bpm

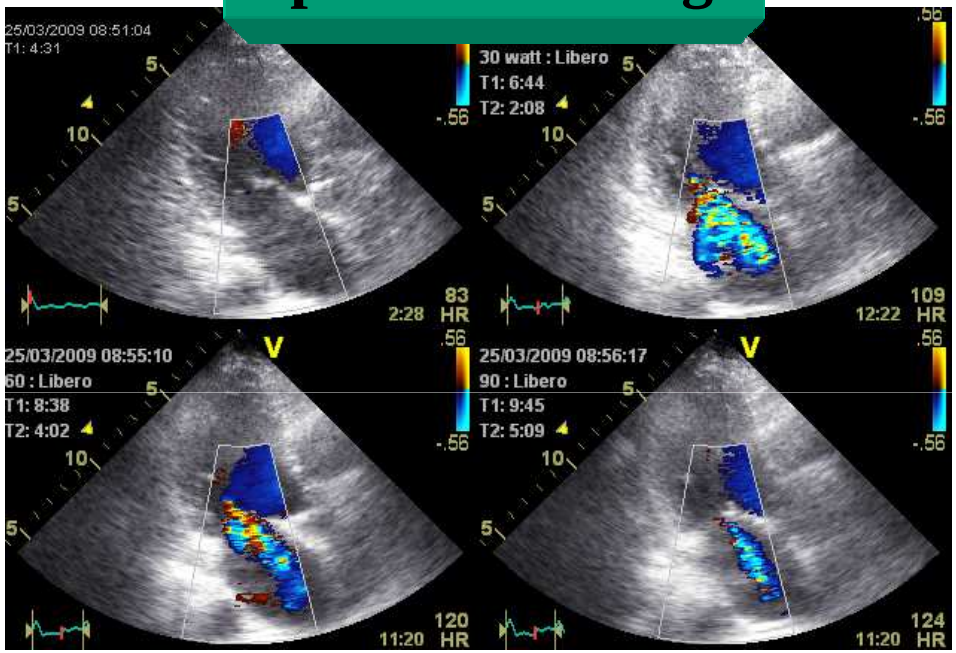
90 watts 125 bpm

Caso 7 Cardiomiopatia dilatativa idiopatica
IM SEVERA - PREGRESSO EPA
SINTOMATOLOGIA DUBBIA –DIAGNOSI RECENTE

Apicale 4c



Apicale asse lungo

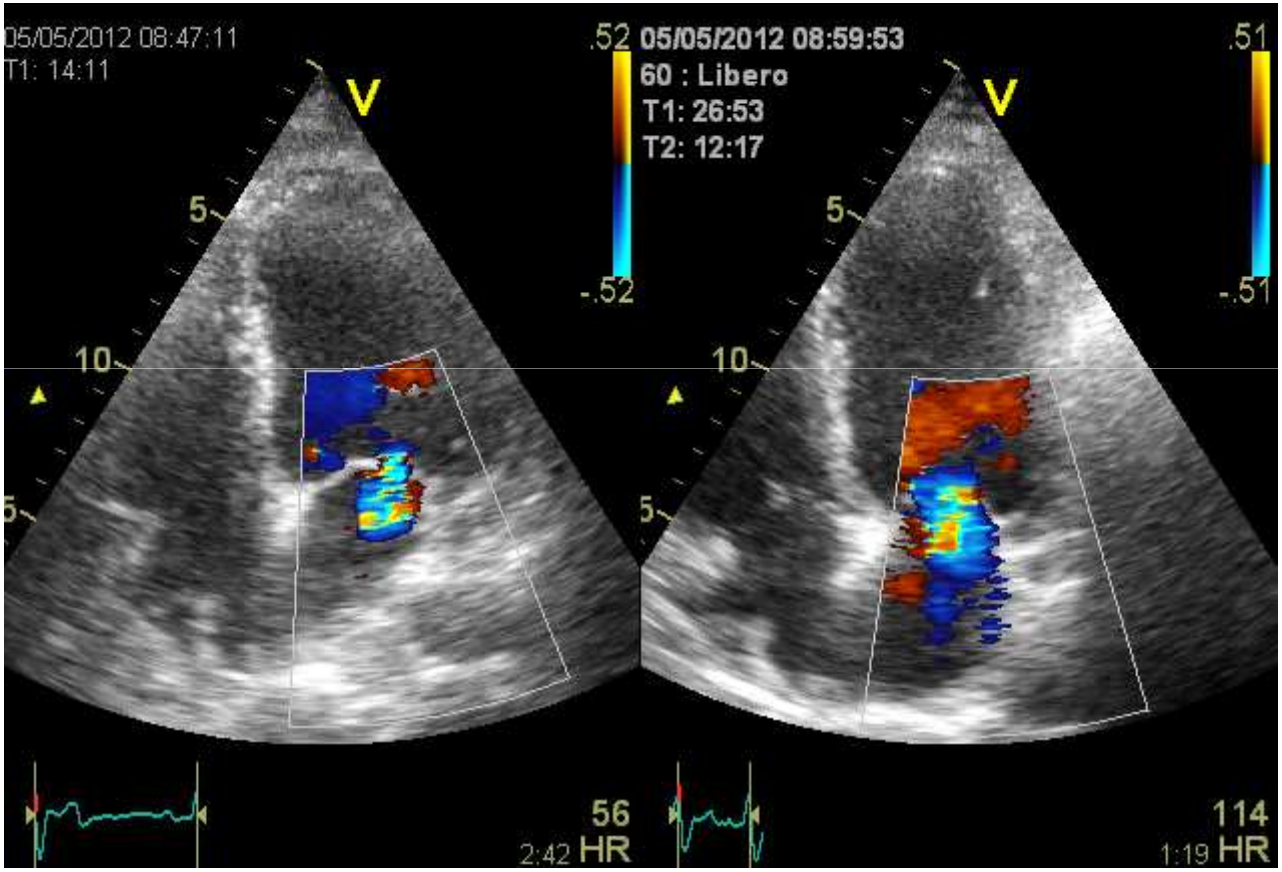


TENTATIVO INEFFICACE DI MASSIMIZZAZIONE DI TERAPIA MEDICA

EPISODI DI DISPNEA A SOGLIA VARIABILE

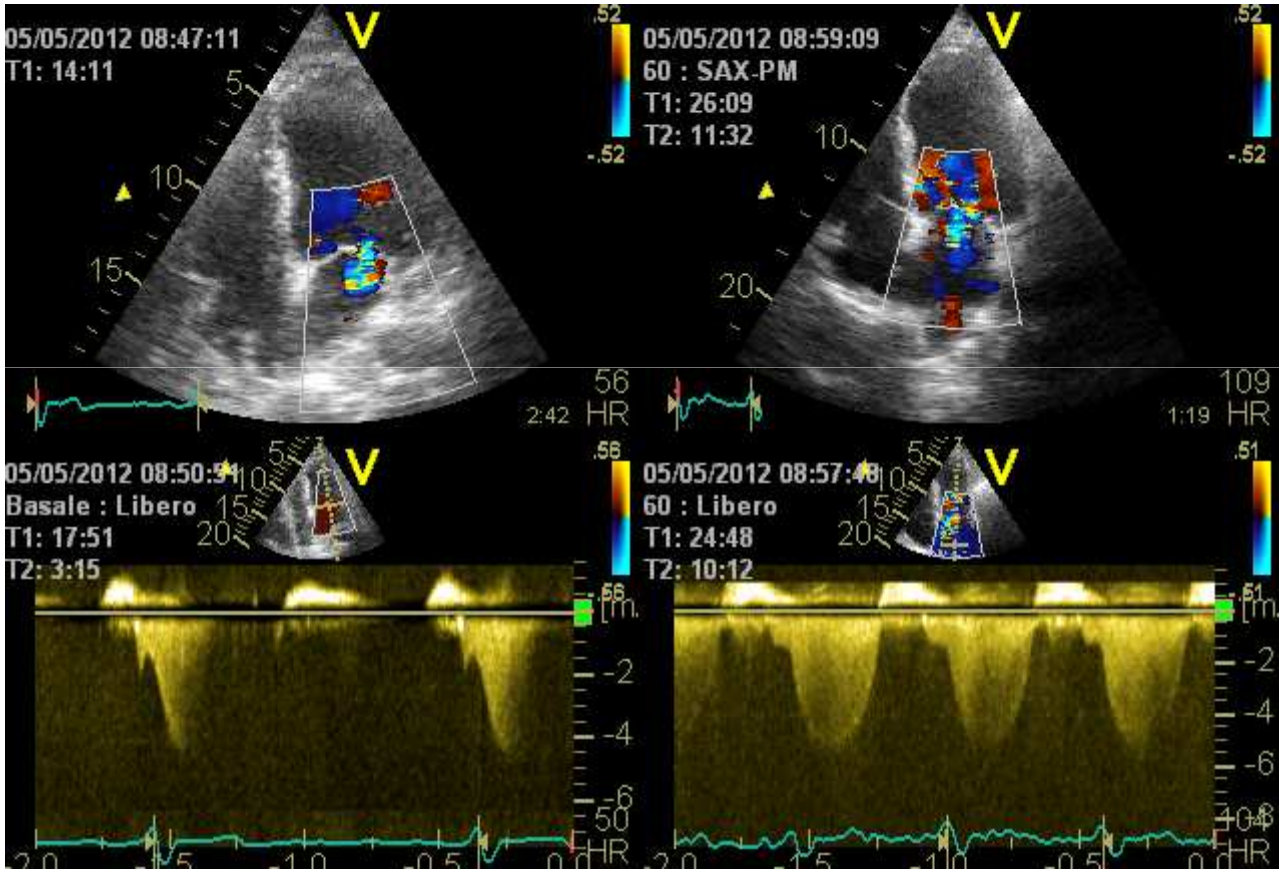
ANNULOPLASTICA

Caso 8 Cardiopatia post-infartuale
IM moderata - PREGRESSO IMA anteriore – coronaropatia non suscettibile d'intervento (malattia IVA dffusa)
SINTOMATOLOGIA VARIABILE, ATIPICA



RISPOSTA BIFASICA ISCHEMICA, INCREMENTO IM: POTENZIAMENTO TERAPIA MEDICA

Caso 8 Cardiopatia post-infartuale
IM moderata - PREGRESSO IMA anteriore – coronaropatia non suscettibile d'intervento (malattia IVA dffusa)
SINTOMATOLOGIA VARIABILE, ATIPICA



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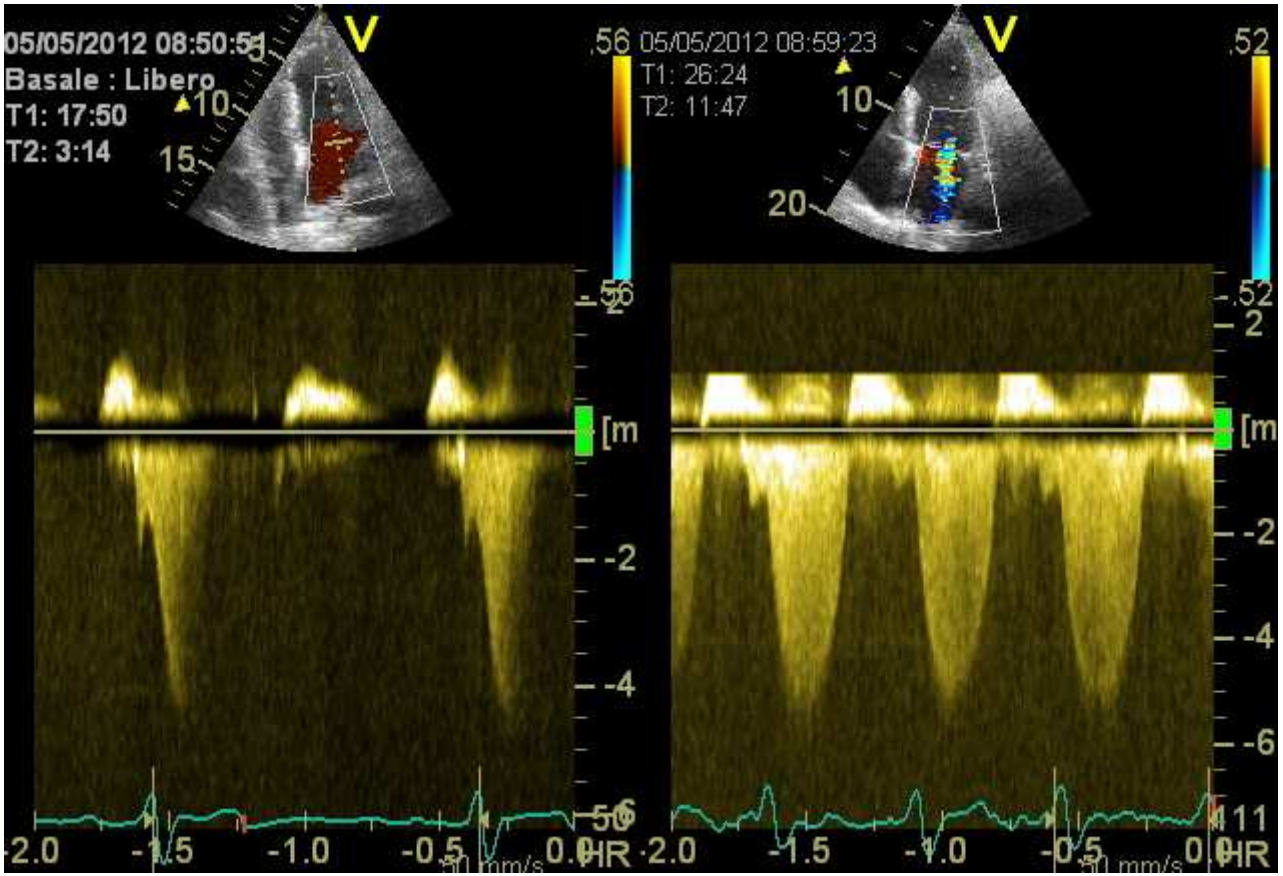
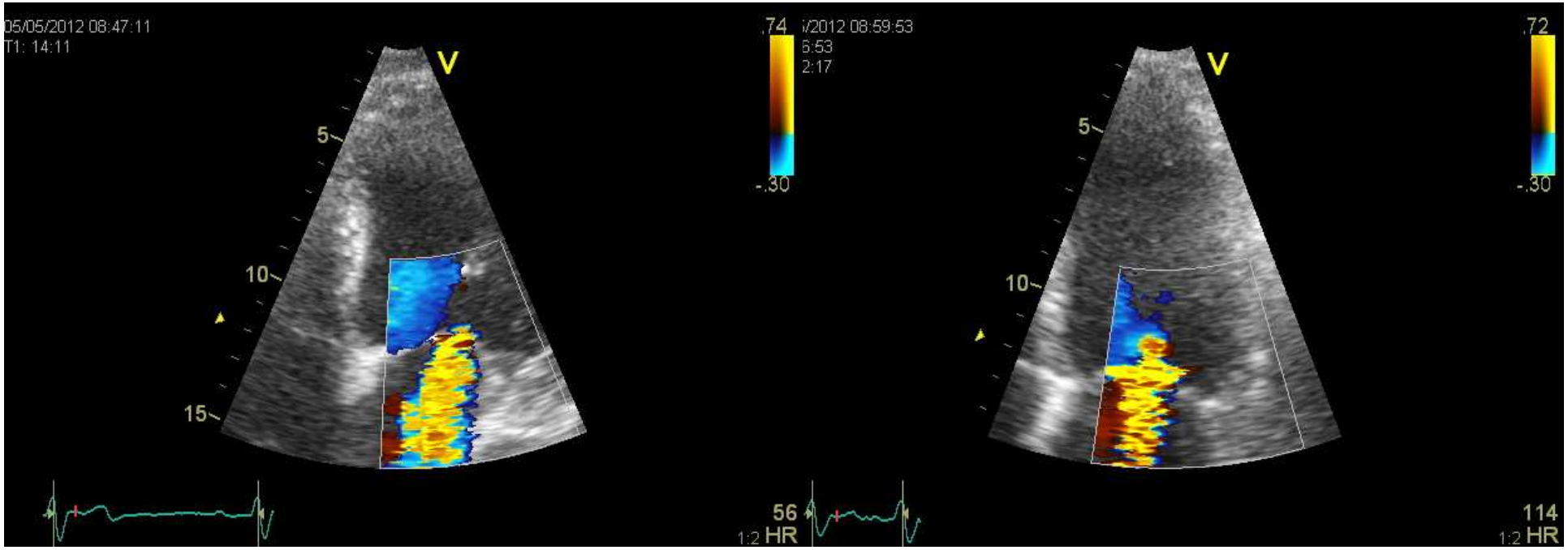
SINTOMATOLOGIA VARIABILE, ATIPICA



Proto-mesosistolico **Olosistolico**

Caso 8 Cardiopatia post-infartuale
IM moderata - PREGRESSO IMA anteriore – coronaropatia non suscettibile d’intervento (malattia IVA dffusa)
SINTOMATOLOGIA VARIABILE, ATIPICA



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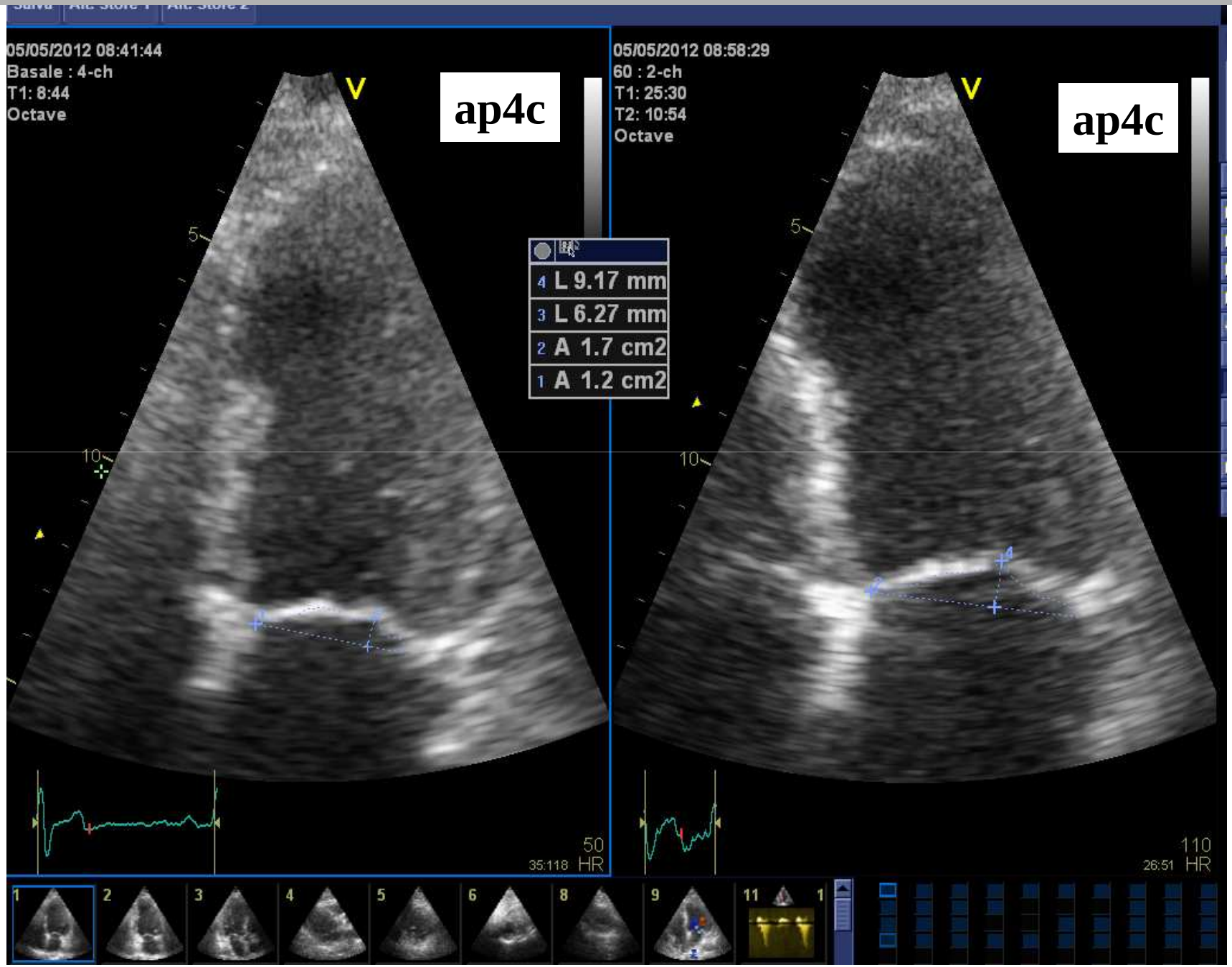

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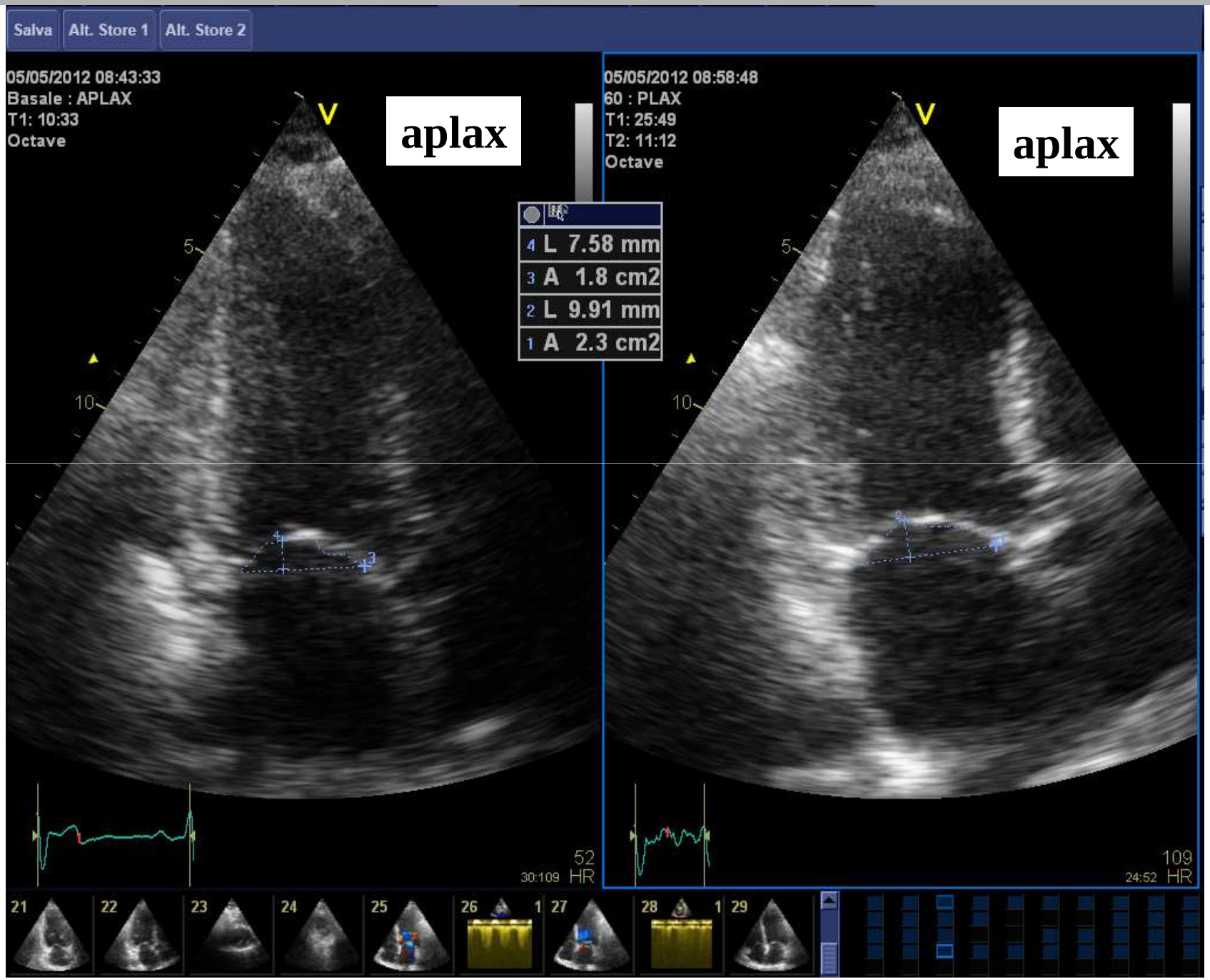
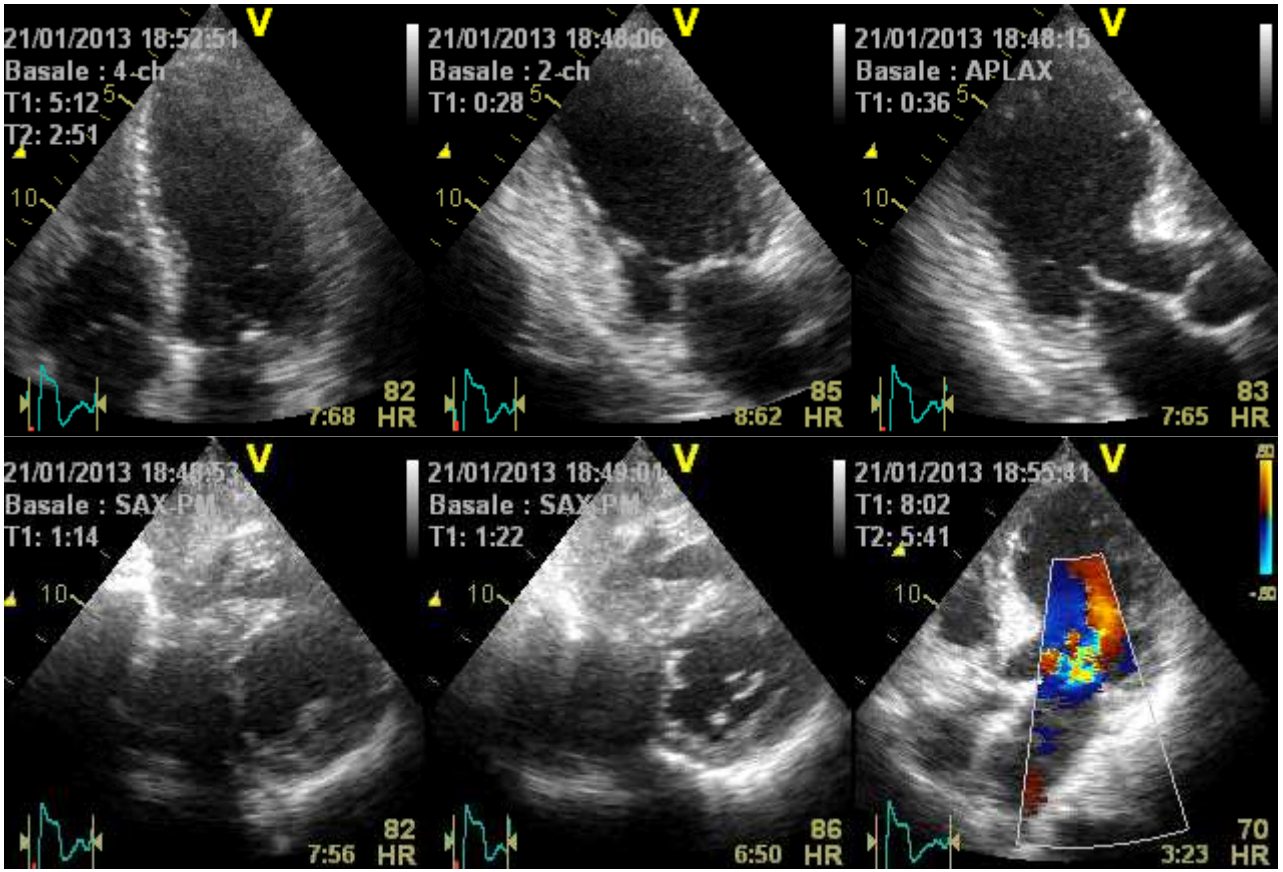
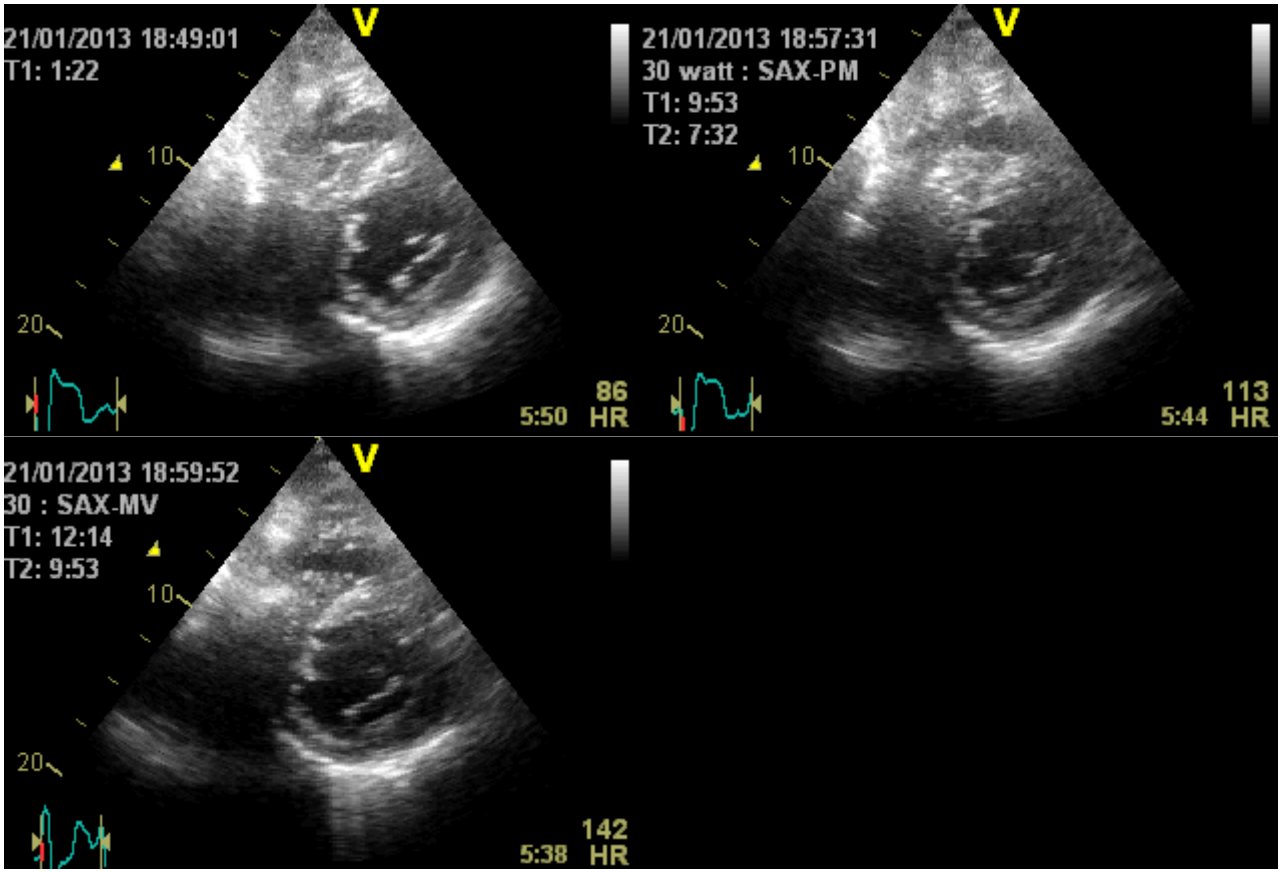


Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



Eco a riposo: FEVS= 42%, dissincronia di contrazione, IM lieve

Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



Eco a riposo: FEVS= 42%, dissincronia di contrazione, IM lieve

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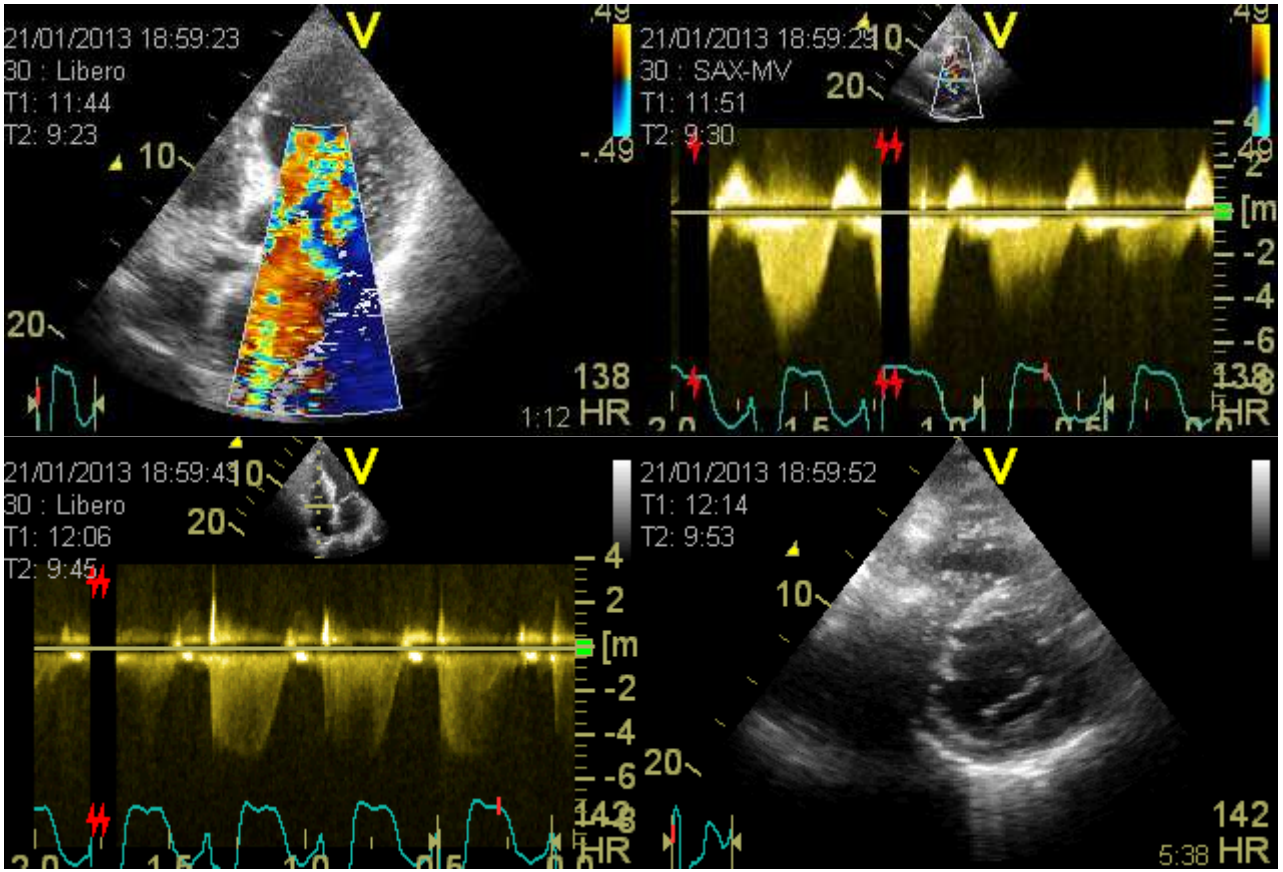
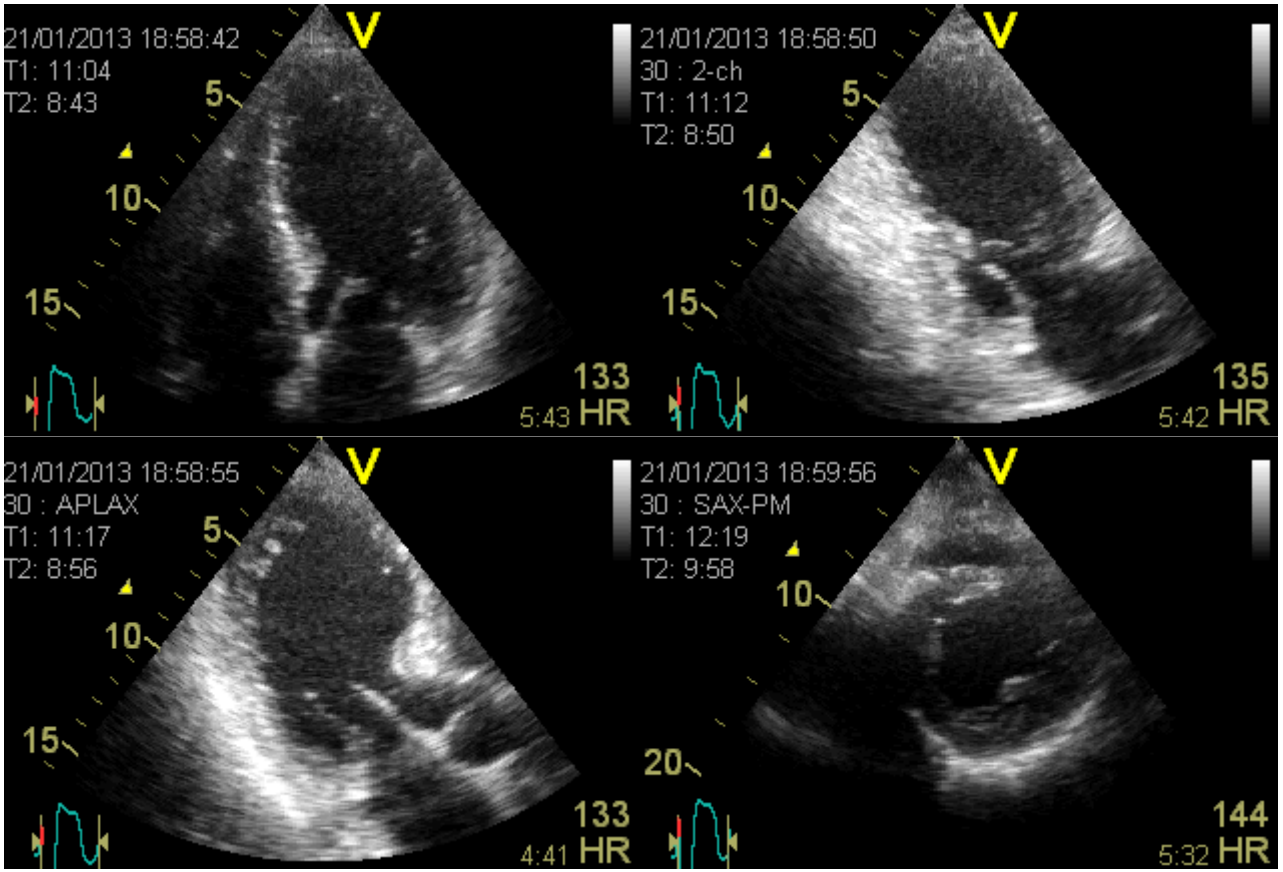


30 watt: IM di grado severo ipertensione polmonare

Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



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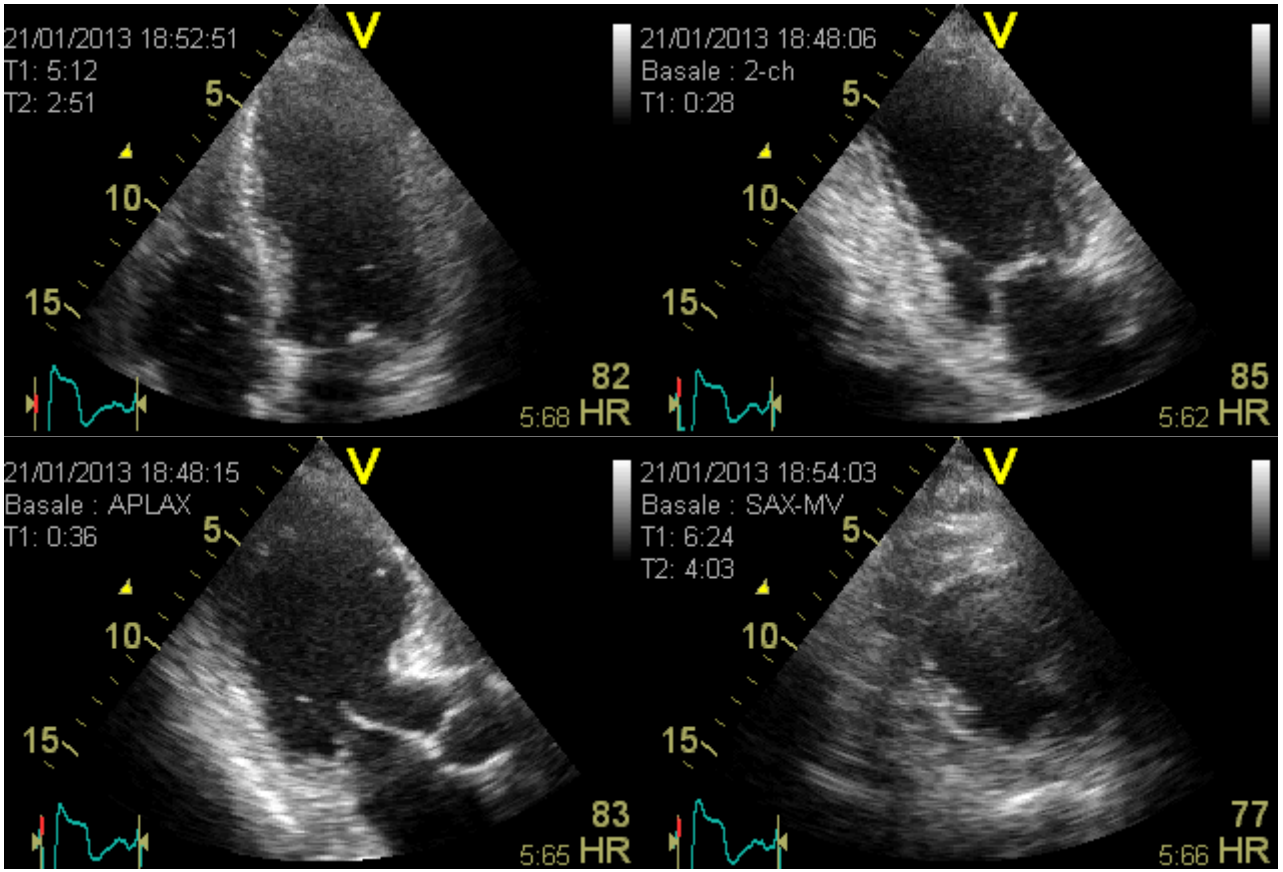
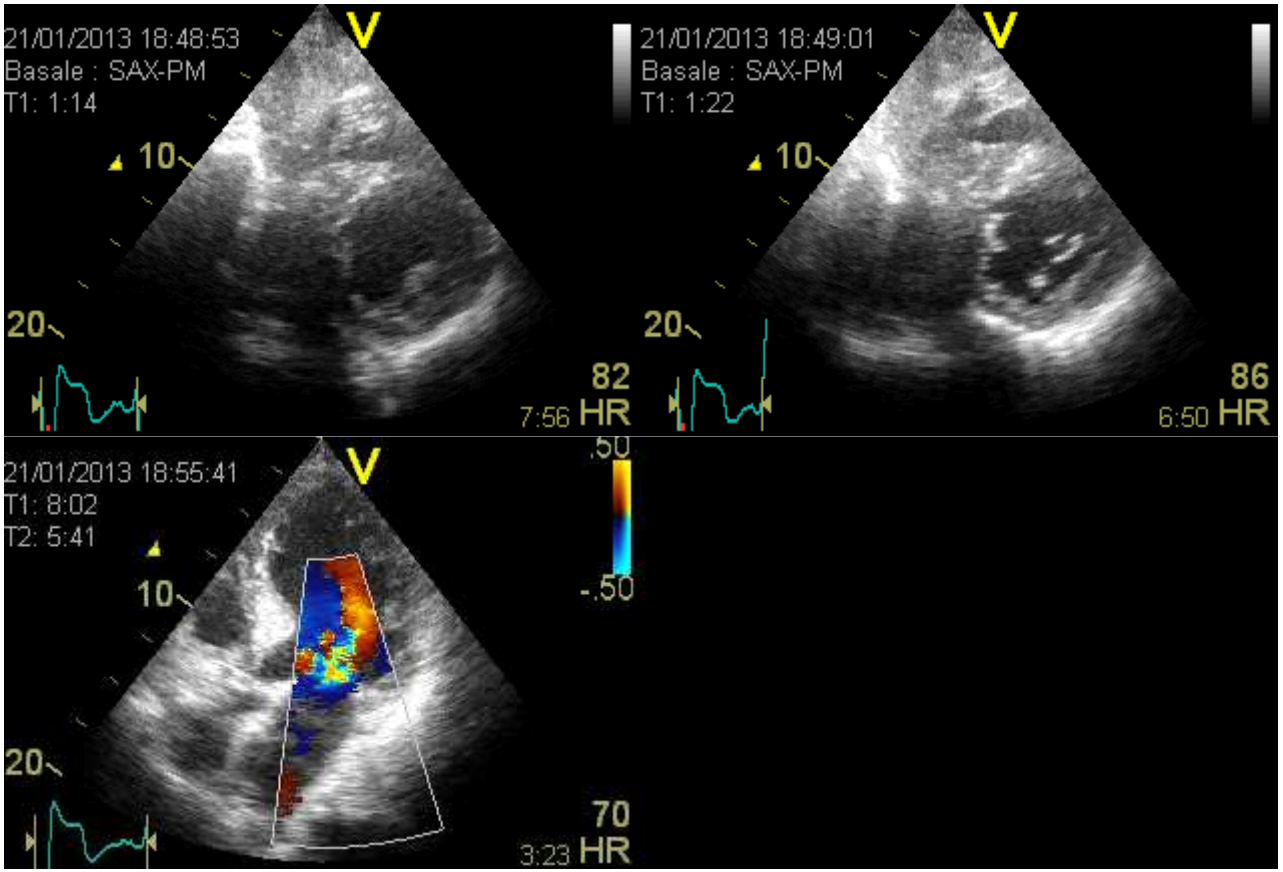


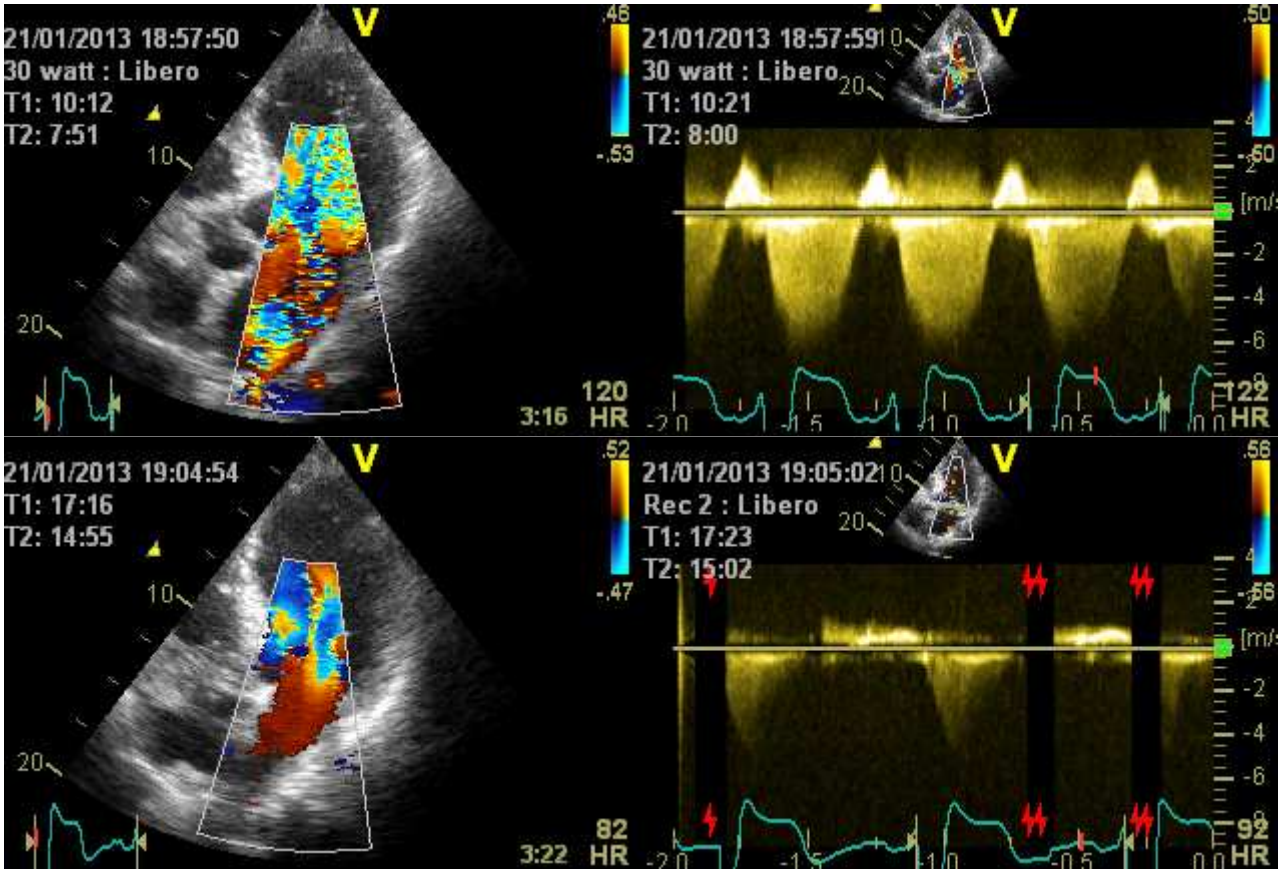
basale

Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



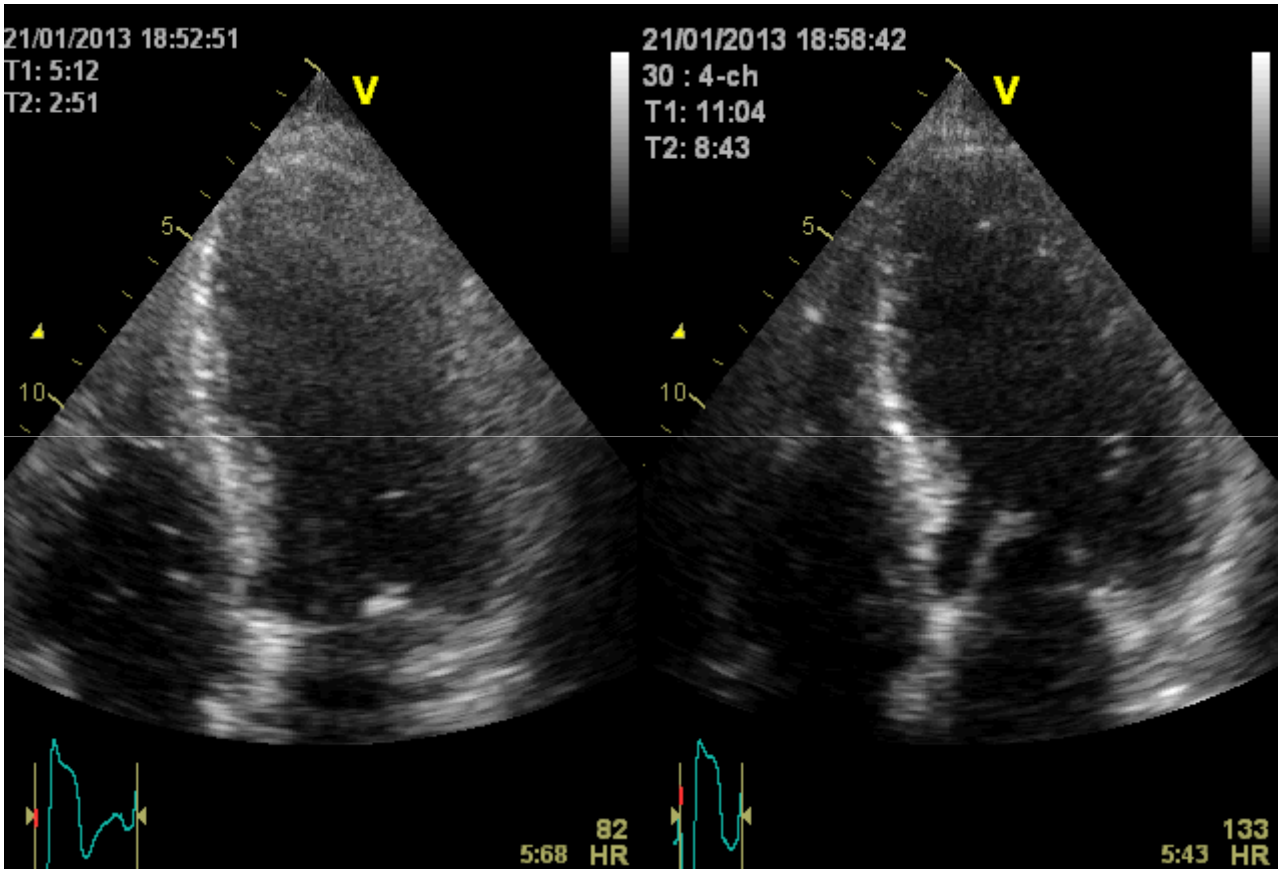
Basale e recupero: IM di grado lieve

Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



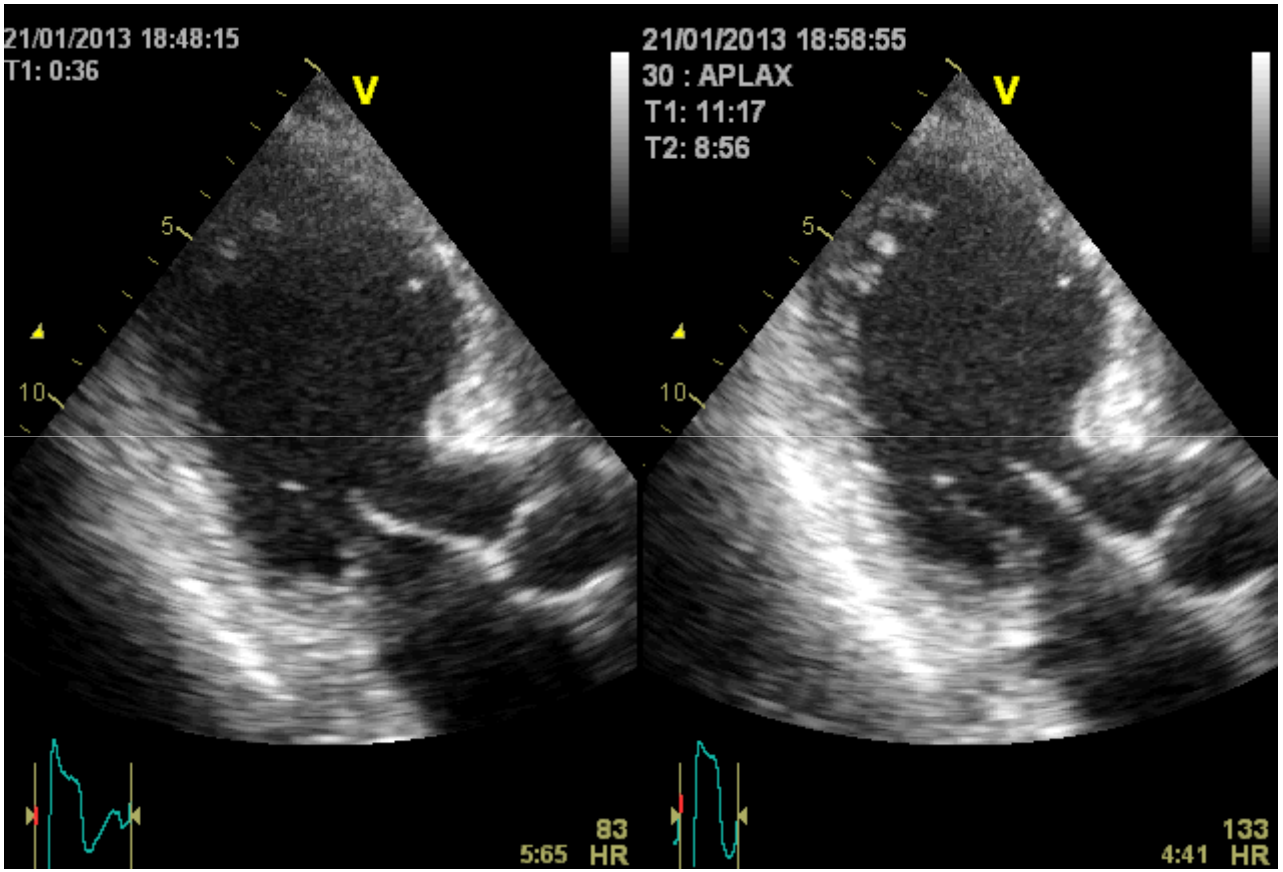
30 watt: IM di grado severo, Rcecupero: IM lieve

Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



30 watt: IM di grado severo ipertensione polmonare

Caso 9 Cardiopatia post-infartuale - BBS
PREGRESSO IMA laterale – PTCA+STENT su Cx.
DISPNEA DA SFORZO A BASSA SOGLIA



30 watt: IM di grado severo ipertensione polmonare

Eco da sforzo nella valutazione funzionale delle valvulopatie

- Insufficienza aortica: sintomi, VS
- Stenosi aortica: sintomi, gradiente, VS, PAS, ECG
- Stenosi mitralica: sintomi, gradiente VM, PAPs
- Insufficienza mitralica: sintomi, entità rigurgito, meccanismo rigurgito, VS, PAPs

Eco da sforzo e valvulopatie

- Fattibilità: sì
- Informazioni diagnostiche: discrepanza sintomi/eco a riposo (può “riclassificare” i pazienti)
- Valore prognostico: severità del rigurgito nell’IM funzionale/cardiopatia ischemica, PAPs e RVol nella IM degenerativa; incremento del gradiente e “test patologico” nella SA
- Indicazioni terapeutiche: caso per caso

  (non provato il peso prognostico della scelta terapeutica basata sull’eco da sforzo)

Ecocardiogramma da sforzo

Grazie dell’attenzione

Semplicità di esecuzione

Basso costo